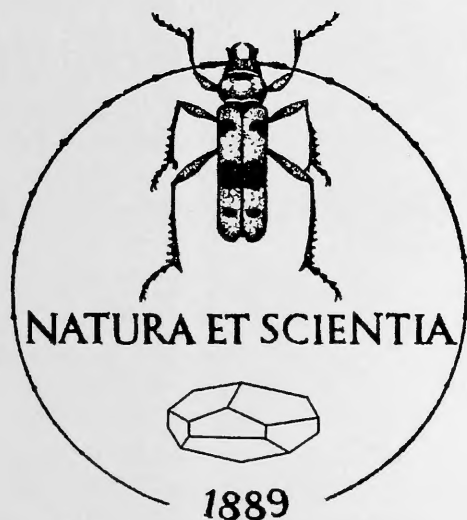


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РЕДАКЦИОННА КОЛЕГИЯ

ст.н.с. Петър БЕРОН
(отговорен редактор)
ст.н.с. Алекси ПОПОВ (секретар)
ст.н.с. Красимир КУМАНСКИ
ст.н.с. Стоице АНДРЕЕВ
ст.н.с. Златозар БОЕВ

Адрес на редакцията

Българска академия на науките -
Национален природонаучен музей
1000 София
бул. Цар Освободител 1

EDITORIAL BOARD

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Stoitse ANDREEV
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Address

National Museum of Natural History
1, Tsar Osvooboditel Blvd
1000 Sofia

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НАЦИОНАЛЕН ПРИРОДОНАУЧЕН МУЗЕЙ

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Revised check-list of digger wasps (Hymenoptera: Sphecidae) from the collection of N. Nedelkov at the National Museum of Natural History in Sofia

Toshko LJUBOMIROV

Introduction

High school teacher Nikola Nedelkov from Sofia published some of the first scientific reports on the Bulgarian sphecid wasp fauna (NEDELKOV, 1909; NEDELKOV, 1914). Before that only Dimitar Joakimoff (JOAKIMOFF, 1899) had reported five sphecid species in the Rila Mountain. Nedelkov did not restrict his study to a single group of insect families or to a single order. He discussed almost all main insect orders in his publications. This made the results obtained by Nedelkov rather doubtful as far as large groups were concerned, because at that time they were quite insufficiently studied from faunistic and taxonomic points of view (for instance, many Diptera; Homoptera; Hymenoptera: Ichneumonoidea, Chalcidoidea, Proctotrupeoidea). However, most of the West-Palaeartic sphecid wasp species were already relatively well-known and their classification was almost completed. In species determination and reference making, Nedelkov used one of the best works on Sphecidae in Europe at that time - the work of Andrea Dahlbom (DAHLBOM, 1843-1845). Therefore, the sphecid material was to a great extent correctly determined and reported despite some misidentifications and misreports in Nedelkov's well-preserved and labelled collection containing 364 digger wasp specimens. The goal of the present study is to correct these misidentifications, to give a full list of the sphecid species reported by Nedelkov including data collected by the same author but unpublished so far. At present the whole collection of Nedelkov is deposited in five boxes in the entomological collection of the National Museum of Natural History in Sofia. The new species for the Bulgarian fauna established are marked with an asterisk.

The sphecid material in the publication of N. Nedelkov from 1909

In 1909 the paper of Nedelkov "Our Entomological Fauna" was published in the Archive of the Ministry of Education (Arhiv na Ministerstvoto na narodnoto prosveshenie). There Hymenoptera together with many other insect groups (mostly Orthoptera and Coleoptera) was included in a list of 73 species, 11 of which were sphecids, as well as one undetermined *Cerceris* species. The sphecid material was collected by the author in Svishtov, Varna, Stara Zagora, Rhodope Mountains, Assenovgrad, Sozopol and Bourgas. Nedelkov also revised two small collections in Chirpan made by N. Botusharov and P. Dimitrov.

Sphecinae

Sceliphron (Sceliphron) spirifex (Linnaeus, 1758). *Pelopaeus spirifex*: p. 125: VII, Varna, ♀1 ; Chirpan, (P. Dimitrov), no preserved material.

Isodontia paludosa (Rossi, 1790). *Sphex paludosa*: p. 125: VII, Svishtov, no preserved material.

Podalonia hirsuta (Scopoli, 1763). *Psammophila hirsuta*: p. 125: ?VI, Rhodope Mts.: nearby Bachkovski Monastery, 1 ♀. *Psammophila affinis*: p. 125: VII, Sredna Gora Mts, 2 ♂♂, misidentified.

Ammophila heydeni Dahlbom, 1845. *Ammophila holosericea*: p. 125: VII, VIII, Bourgas, 1 ♀; Sozopol, no preserved material; Asenovgrad, no preserved material; Chirpan (N. Botusharov), no preserved material.

Ammophila sabulosa (Linnaeus, 1758). *Ammophila sabulosa* (sic): p. 125: VII, Rhodope Mts, 1 ♂, 1 ♀; VIII, Rhodope Mts, 1 ♂.

Bembicinae

Bembix oculata Panzer, 1801. *Bembex neglecta*: p. 125: VII, Varna, no preserved material; Bourgas, 1 ♀.

Bembix olivacea Fabricius, 1787. *Bembex olivacei* (sic): p. 125: VII-VIII, Bourgas, 1 ♂, 1 ♀; ?VII, Varna, 2 ♀♀; Bourgas, 1 ♀.

Philanthinae

Philanthus coronatus (Thunberg, 1784). *Philanthus coronatus*: p. 125: VII, Sredna Gora Mts., no preserved material.

Philanthus triangulum (Fabricius, 1775). *Philanthus triangulum*: p. 125: VIII, Stara Zagora, 1 ♂; ?VII, ?1916, Bourgas, 1 ♀.

Cerceris rubida (Jurine, 1807). *Cerceris* sp.: p. 124: Devnya, 1 ♀, erroneously designated by Nedelkov as male.

Cerceris sabulosa (Panzer, 1799). *Cerceris minuta*: p. 124: VIII, Stara Zagora, 1 ♂.

The sphecid material in the publication of N. Nedelkov from 1914

In his "Seventh Contribution to the Entomological Fauna of Bulgaria" Nedelkov reported at least 98 sphecid species under 104 specific names. In this paper he included material published in 1909 as well. The publication appeared in 1914 and contained only data on Hymenoptera. The material was collected by N. Nedelkov (from the vicinities of Sofia), by S. Kozarov (from Stara Zagora, Kyustendil, Kostenets, Sofia and vicinities), by D. Vezhev (from Bourgas), by K. Seizov (from Provadia), by T. Penev (from Pazardzhik), by P. Ramnarov (from Svishtov), and by I. Stribrni (from Sadovo).

Sphecinae

Sceliphron (Sceliphron) destillatorium (Illiger, 1807). *Sceliphron distillatorius* (sic): p. 199: VII, Vidin, 1 ♀; VII, Sofia, 1 ♂; VII, Pancharevo, 1 ♀; VII, Stara Zagora, 1 ♂, 1 ♀. *Sceliphron spirifex*: p. 199: V, Pazardjik, 1 ♀; VII, Stara Zagora, 1 ♀; VII, Bourgas, 1 ♀, misidentified. Unpublished material: VII, Kazanlak, 1 ♀, determined - *Sceliphron spirifex*; Sadovo, 1 ♀, determined: *Sceliphron spirifex*.

Sceliphron (Sceliphron) spirifex (Linnaeus, 1758). *Sceliphron spirifex*: p. 199: VII, Veliko Turnovo, 1 ♀; VII, Stara Zagora, 2 ♀♀. Unpublished material: VII, Kazanlak, 1 ♀, determined - *Sceliphron spirifex*; VIII, Sliven, 1 ♀, determined - *Sceliphron spirifex*; Stara Zagora, 2 ♀♀; Pazardjik, 1 ♂, 2 ♀♀.

Sphex (Sphex) funerarius Gussakovskij, 1934. *Sphex maxillosus*: p. 199: VII, Bourgas, 1 ♂.

Prionyx kirbii (Vander Linden, 1827). *Sphex albisectus*: p. 199: VII, Pancharevo, 1 ♀; VI, Ihtiman, 1 ♂; VII, Rhodope Mts.: Batchkovski Monastery, 1 ♀; VII, Bourgas, 1 ♀.

Podalonia affinis (W. Kirby, 1798). *Psammophila tydei*: p. 199: VII, Rhodope Mts., 1 ♀, misidentified.

Podalonia fera (Lepeletier, 1845). *Psammophila tydei*: p. 199: VI, Pancharevo, 2 ♀♀; VIII, Sofia: Pancharevo sub. 1 ♀; VII, Stara Zagora, 1 ♀, misidentified.

Podalonia hirsuta (Scopoli, 1763). *Psammophila affinis*: p. 199: VII, Sredna Gora Mts., 2 ♂♂, misidentified. *Psammophila hirsuta*: p. 199: Sredna Gora Mts., 1 ♂; 1 ♀; VIII, Rila Mtn: Rilski Monastery, 1 ♀; VIII, Rila Mtn: Samokov, 1 ♀; Pazardjik, 2 ♂♂; VII, Stara Planina Mts., 2 ♂♂, 1 ♀; VII, Sofia, 2 ♀♀; VII, Pancharevo, 1 ♀. *Psammophila tydei*: p. 199: VII, Rhodope Mts., 1 ♂;

V, Lyulin Mtn., 1 ♀; VI, Pancharevo, 1 ♀; VII, Pancharevo, 1 ♂; VI, Ihtiman, 3 ♂♂, 2 ♀♀; Byala Tcherkva, 1 ♂; IV, Sofia, 1 ♀; VI, Sofia, 1 ♀; VI, Rhodope Mts.: Batchkovski Monastery, 1 ♀, misidentified. Unpublished material: V, Lyulin Mtn, 1 ♀, determined: *Psammophila hirsuta*.

***Podalonia tydei* (Le Guillou, 1841).** *Psammophila tydei*: p. 199: VII, Svishtov, 1 ♂; VI, Sofia: Pancharevo sub., 1 ♂.

***Ammophila heydeni* Dahlbom, 1845.** *Ammophila campestris*: p. 199: VII, Pancharevo, 1 ♂, misidentified. *Ammophila heydeni*: p. 199: VI, Svoqe, 1 ♀; VII, Pancharevo, 3 ♀♀; Pancharevo, 1 ♂; Sredna Gora Mts., 1 ♂, 1 ♀; VII, Haskovo, 1 ♂; VII, Bourgas, 1 ♀. Unpublished material: VIII, Pancharevo, 1 ♂, 1 ♀, determined - *Ammophila heydeni*; VIII.

***Ammophila sabulosa* (Linnaeus, 1758).** *Ammophila apicalis*: p. 199: VI, Svoqe, 1 ♂; VI, Sofia: Vladaya sub., 1 ♂ (LJUBOMIROV, 2000b); VI, Vitosha Mtn., 3 ♂♂ (LJUBOMIROV, 2000b); V, Rhodope Mts., 1 ♂, misidentified. *Ammophila sabulosa*: p. 199: Vratsa, 1 ♂; VI, Vitosha Mtn., 1 ♀ (LJUBOMIROV, 2000b); VII, Vitosha Mtn., 1 ♂ (LJUBOMIROV, 2000b); VI, Sredna Gora Mts., 1 ♂; VI, Rila Mtn., 2 ♂♂; VII, Rila Mtn., 2 ♀♀; VIII, Rila Mtn.: Borovets, 1 ♂, 1 ♀; VII, Rhodope Mts., 1 ♂, 1 ♀; VIII, Rhodope Mts., 1 ♂.

Pemphredoninae

***Mimesa* sp.** *Mimesa bicolor*: p. 199: VII, Svishtov, 1 ♂. It is impossible to determinate the correct specific appurtenance - the material is damaged.

****Mimumesa atratina* (F. Morawitz, 1891).** *Mimesa bicolor*: p. 199: VII, Pancharevo, 1 ♂, misidentified. *Mimesa dahlbomi*: p. 199: VII. Pancharevo, 2 ♂♂, misidentified. Unpublished material: VIII, Pancharevo, 1 ♀, determined - *Mimumesa dahlbomi*.

***Mimumesa dahlbomi* (Wesmael, 1852).** *Mimesa dahlbomi*: p. 199: V, Sofia, 1 ♂.

***Mimumesa unicolor* (Vander Linden, 1829).** *Mimesa unicolor*: p. 199: VII, Pancharevo, 2 ♂♂, 1 ♀.

***Mimumesa* sp.** *Mimesa unicolor*: p. 199: VII, Pancharevo, 1 ♀. It is impossible to determinate the correct specific appurtenance - the material is damaged.

***Psenulus fuscipennis* (Dahlbom, 1843).** *Psenulus fuscipennis*: p. 199: V, Sofia, 1 ♀; VI, Sofia, 1 ♀.

***Psenulus pallipes* (Panzer, 1798).** *Mimesa unicolor*: p. 199: V, Sofia, 1 ♀, misidentified. *Psenulus atratus*: p. 199: VII, Pancharevo, 1 ♂, 1 ♀. *Psenulus fuscipennis*: p. 199: VI, Sofia, 2 ♀♀; VII, Stara Zagora, 2 ♂♂, determined as females, misidentified. Unpublished material: IV, Sofia, 3 ♀♀, determined - *Psenulus fuscipennis*; VI, Sofia, 1 ♀, determined - *Psenulus* sp.

***Diodontus minutus* (Fabricius, 1793).** *Diodontus luperus*: p. 196: V, Sofia, 1 ♀, misidentified.

***Pemphredon inornata* Say, 1824.** Unpublished material: IV, Sofia, 1 ♀; V, Sofia, 1 ♀; VII, Sofia, 2 ♂♂; Sofia, 2 ♂♂. All six specimens determined - *Pemphredon* sp.

***Pemphredon lethifer* (Shuckard, 1837).** Unpublished material: VIII, Vitosha Mtn.: Bistritsa vill., 1 ♀, (LJUBOMIROV, 2000b); VI, Sofia, 1 ♀; VII, Sofia, 1 ♀; VII, Pancharevo, 1 ♂, 1 ♀; Pancharevo, 1 ♀. All six specimens determined - *Pemphredon* sp.

***Pemphredon lugubris* (Fabricius, 1793).** *Pemphredon lugubris*: p. 196: VIII, Sofia, 1 ♀.

***Pemphredon morio* Vander Linden, 1829.** *Pemphredon clypealis* Thomson: VI, Sofia, 1 ♀.

***Pemphredon rugifer* Dahlbom, 1844.** Unpublished material: IV, Sofia, 1 ♀; V, Sofia, 1 ♀, determined - *Pemphredon* sp.

***Passaloecus corniger* Shuckard, 1837.** *Passaloecus corniger*: p. 196: VI, Sofia, 1 ♀. *Pemphredon clypealis*: p. 196: V, Sofia, 1 ♀, misidentified.

***Passaloecus gracilis* (Curtis, 1834).** *Passaloecus brevicornis*: p. 196: V, Sofia, 1 ♂. *Passaloecus eremita*: p. 196: VI, Sofia, 1 ♂, erroneously designated by Nedelkov as a female, misidentified. *Pemphredon clypealis*: p. 196: VI, Sofia, 1 ♀, misidentified.

****Passaloecus pictus* Ribaut, 1952.** *Passaloecus brevicornis*: p. 196: V, Sofia, 2 ♀♀.

***Passaloecus singularis* Dahlbom, 1844.** *Passaloecus tenuis*: p. 196: ?VIII, Vitosha Mtn., 1 ♀ (LJUBOMIROV, 2000b). *Stigmaeus solskyi*: p. 196: V, Sofia, 1 ♂, misidentified.

***Stigmaeus (Stigmaeus) solskyi* A. Morawitz, 1864.** *Stigmaeus solskyi*: p. 196: V, Sofia, 9 ♂♂; VI, Sofia, 1 ♂; VI, Sofia, 1 ♂, erroneously designated by Nedelkov as a female; Sofia, 1 ♀. Unpublished material: IV, Sofia, 1 ♀, determined - *Stigmaeus solskyi*.

Astatinae

***Astata jucunda* Pulawski, 1959.** *Astata boops*: p. 198: VII, Pancharevo, 1 ♂. *Astata minor*: p. 198: VII, Pancharevo, 1 ♀, misidentified.

***Astata minor* (Kohl, 1885).** *Astata minor*: p. 198: VI, Sofia, 1 ♂. Unpublished material: VI, Sofia, 1 ♂.

***Astata rufipes* Mocsary, 1883.** *Astata rufipes*: p. 198: VII., Pancharevo, 1 ♀. Unpublished material: VIII, Pancharevo, 1 ♂, determined - *Astata minor*.

****Dryudella picticornis* (Gussakovskij, 1927).** *Astata stigma*: p. 198: VII, Pancharevo, 1 ♀.

***Dinetus pictus* (Fabricius, 1793).** *Dinetus pictus*: p. 196: VI, Vratschanska Mtn.: Rebarkovo vill., 1 ♂; VII, Pancharevo, 1 ♀.

Crabroninae

***Larra (Larra) anathema* (Rossi, 1790).** *Larra anathema*: p. 198: VII, Stara Zagora, 1 ♂; Bourgas, 1 ♂.

***Liris (Leptolarra) niger* (Fabricius, 1775).** *Notogonia pompiliformis*: p. 198: VII, Pancharevo, 1 ♀.

***Tachytes panzeri* Dufour, 1841.** *Tachytes europaeus*: p. 197: VII, Pancharevo, 1 ♀.

***Tachysphex panzeri* (Vander Linden, 1829).** *Tachysphex panzeri*: p. 198: VII, Pancharevo, 1 ♀.

***Tachysphex pompiliformis* (Panzer, 1804).** *Tachysphex pygidialis*: p. 197: VI, Pancharevo, 1 ♀, misidentified. *Tachysphex panzeri*: p. 198: VII, Pancharevo, 1 ♀, misidentified. *Tachysphex pectinipes*: p. 198: VI, Ichtiman, 1 ♀.

***Palarus variegatus* (Fabricius, 1781).** *Palarus flavipes*: p. 197: VII, Pancharevo, 1 ♂; VII, Ichtiman, 1 ♀.

***Trypoxylon (Trypoxylon) attenuatum* F. Smith, 1851.** *Trypoxylon attenuatum*: p. 199: V, Sofia, 1 ♀.

***Trypoxylon (Trypoxylon) clavicerum* Lepeletier et Serville, 1828.** *Trypoxylon clavicerum*: p. 199: VII, Plana Mtn.: German, 1 ♀.

***Trypoxylon (Trypoxylon) figulus* (Linnaeus, 1758).** *Trypoxylon figulus*: p. 199: V, Sofia, 1 ♀; VI, Sofia, 1 ♀; VII, Sofia, 1 ♀; VII, Vitosha Mtn., 1 ♀ (LJUBOMIROV, 2000b).

***Trypoxylon (Trypoxylon) kolazyi* Kohl, 1893.** *Trypoxylon clavicerum*: p. 199: IV, Sofia, 1 ♀, misidentified.

****Trypoxylon (Trypoxylon) latilobatum* Antropov, 1991.** *Trypoxylon figulus*: p. 199: VII, Pancharevo, 1 ♀.

***Trypoxylon* spp.** *Trypoxylon figulus*: p. 199: V, Sofia, 1 ♀; VIII, Stara Zagora, 1 ♀, (both specimens are hardly damaged).

***Oxybelus bipunctatus* Olivier, 1812.** *Oxybelus bipunctatus*: p. 196: VII, Sofia, 4 ♀♀. Unpublished material: VIII, Pancharevo, 1 ♀.

***Oxybelus latro* Olivier, 1812.** *Oxybelus latro*: p. 196: VI, Ichtiman, 1 ♀. *Oxybelus latidens*: p. 196: VI, Ichtiman, 1 ♂, erroneously designated by Nedelkov as a female, misidentified.

***Oxybelus mandibularis* Dahlbom, 1845.** *Oxybelus pulchellus*: p. 196: VII, Pancharevo, 1 ♂, misidentified.

***Oxybelus mucronatus* (Fabricius, 1793).** Unpublished material: VII, Stara Zagora, 1 ♂.

***Oxybelus occitanicus* Marquet, 1896.** *Oxybelus pulchellus*: p. 196: VII, Pancharevo, 1 ♂, misidentified.

***Oxybelus quattuordecimnotatus* Jurine, 1807.** *Oxybelus quattuordecimnotatus*: p. 196: VII, Sofia, 1 ♀; Ichtiman, 1 ♀, erroneously designated by Nedelkov as a male; VII, Pancharevo, 1 ♀. *Oxybelus pulchellus*: p. 196: VII,

Pancharevo, 1 ♂, misidentified. Unpublished material: VIII, Pancharevo, 1 ♀, determined - *Oxybelus quattuordecimnotatus*.

***Oxybelus variegatus* Wesmael, 1852.** *Oxybelus pulchellus*: p. 196: VII, Pancharevo, 4 ♂♂; Pazardzik, 1 ♂.

***Entomognathus (Entomognathus) brevis* (Vander Linden, 1829).** *Crossocerus exiguus*: VII, Pancharevo, 1 ♂, erroneously designated by Nedelkov as a female, misidentified. Unpublished material: VII, Pancharevo, 2 ♂♂, 2 ♀♀, determined - *Crabro brevis*.

***Lindenius albilabris* (Fabricius, 1793).** *Lindenius albilabris*: p. 196: VI, Svoqe, 1 ♂; VI, Sofia, 1 ♂; VII, Pancharevo, 1 ♂, 2 ♀♀; Pancharevo, 1 ♂; Stara Zagora, 1 ♂.

***Lindenius laevis* A. Costa, 1871.** *Lindenius albilabris*: p. 196: VI, district of Sofia, 1 ♀, misidentified.

***Rhopalum (Corynopus) coarctatum* (Scopoli, 1763).** *Rhopalum tibialis*: p. 196: V, Sofia, 1 ♀; VI, Sofia, 1 ♂.

***Crossocerus (Acanthocrabro) vagabundus* (Panzer, 1798).** *Cuphopterus vagabundus*: p. 196: ?IV, Sofia, 1 ♂.

***Crossocerus (Blepharipus) annulipes* (Lepelletier & Brullé, 1834).** *Coelocrabro gonager*: p. 196: VI, Sofia, 1 ♂; Sofia: Knyazhevo sub., 1 ♀.

***Crossocerus (Blepharipus) megacephalus* (Rossi, 1790).** *Coelocrabro leucostoma*: p. 196: ?VIII, Vitosha Mtn., 1 ♀ (LJUBOMIROV, 2000b). *Coelocrabro barbipes*: p. 196: Sofia: Dragalevtsi sub., 1 ♀ (LJUBOMIROV, 2000b), misidentified.

***Crossocerus (Crossocerus) exiguus* (Vander Linden, 1829).** *Crossocerus wesmaeli*: p. 196: Sofia, 1 ♀, misidentified.

***Crossocerus (Hoplocrabro) quadrimaculatus* (Fabricius, 1793).** *Hoplocrabro quadrimaculatus*: p. 196: VII, Sofia., 1 ♀; Sofia, 2 ♀♀.

***Crabro (Crabro) cribrarius* (Linnaeus, 1758).** *Thyreopus cribrarius*: p. 196: VII, Stara Planina Mts., 2 ♂♂, 1 ♀; VI, Rila Mtn., 1 ♂; ? "Godoyk", 1 ♀.

***Crabro (Crabro) peltarius* (Schreber, 1784).** *Thyreopus peltarius*: p. 196: VI, Sofia, 1 ♂; VI, Ihtiman, 1 ♂.

***Crabro (Crabro) scutellatus* (Scheven, 1781).** *Thyreopus scutellatus*: p. 196: V, Pancharevo, 1 ♂.

***Ectemnius (Clytochrysus) cavifrons* (Thomson, 1871).** *Clytochrysus planifrons*: p. 195: V, Sofia, 1 ♂.

***Ectemnius (Clytochrysus) lapidarius* (Panzer, 1804).** *Thyreopus peltarius*: p. 196: VII, Troyan, 1 ♀, misidentified.

***Ectemnius (Ectemnius) dives* (Lepelletier & Brullé, 1834).** *Ectemnius dives*: p. 195: VII, Pancharevo, 1 ♀. *Hoplocrabro quadrimaculatus*: p. 196: Sofia, 1 ♀, misidentified.

***Ectemnius (Hypocrabro) continuus* (Fabricius, 1804).** *Solenius vagus*: p. 195: VI, Svoqe, 1 ♂; Sadovo, 1 ♂.

***Ectemnius (Hypocrabro) hypsae* (de Stefani, 1894).** *Solenius vagus*: p. 195: Sadovo, 1 ♀, misidentified.

***Ectemnius (Hypocrabro) meridionalis* (A. Costa, 1871).** *Thyreus clypeatus*: p. 195: VI, Stara Zagora, 1 ♀, misidentified.

***Ectemnius (Metacrabro) cephalotes* (Olivier, 1792).** *Crabro quadricinctus*: p. 195: ?V, Sofia, 1 ♀; VII, Sofia, 3 ♀♀; IX, Sofia, 1 ♀; Sofia, 1 ♀; Sadovo, 1 ♂, 1 ♀, misidentified.

***Lestica (Ceratocolus) alata* (Panzer, 1797).** *Ceratocolus alatus*: p. 195: Ihtiman, no preserved material. Unpublished material: VII, Stara Zagora, 1 ♂, determined - *Ceratocolus subterraneus*.

***Lestica (Clypeocrabro) clypeata* (Schreber, 1759).** *Thyreus clypeatus*: p. 195: VII, Svishtov, 1 ♀; VII, Vratsa, 1 ♀; ?VI, Sofia, 1 ♂; VII, Sofia, 1 ♂; VII, Pancharevo, 1 ♂, 2 ♀♀; VIII, Pancharevo, 1 ♂; Pazardzik, 1 ♀; Stara Zagora, 1 ♂; Haskovo, 1 ♀.

***Lestica (Lestica) subterranea* (Fabricius, 1775).** *Ceratocolus subterraneus*: p. 195: VI, Ihtiman, 1 ♀.

Bembicinae

***Mellinus arvensis* (Linnaeus, 1758).** *Mellinus arvensis*: p. 197: ?VIII, Rila Mtn.: Rilsky Monastery, 1 ♀. *Mellinus sabulosus* var. *a*: p. 197: VII, Rila Mtn., 1 ♂, misidentified. *Hoplisis laticinctus*: p. 197: VII, Sofia, 1 ♀, misidentified.

***Alysson spinosus* (Panzer, 1801).** *Alysson fuscatus*: p. 197: VII, Pancharevo, 3 ♀♀; VII, Varna, 1 ♀, (LJUBOMIROV, 2000a). *Alysson pertheesi*: p. 197: VII, Pancharevo, 1 ♂, (LJUBOMIROV, 2000a), misidentified. *Alysson ratzeburgi*: p. 197: Pancharevo, 4 ♂♂, (LJUBOMIROV, 2000a), misidentified. Unpublished material: VIII, Pancharevo, 1 ♂, determined - *Alysson ratzeburgi*, (LJUBOMIROV, 2000a).

***Didineis lunicornis* (Fabricius, 1798).** *Didineis lunicornis*: p. 197: VII, Pancharevo, 1 ♂, (LJUBOMIROV, 2000a).

***Nysson maculosus* (Gmelin, 1790).** *Nysson maculatus*: p. 197: VII, Varna, 1 ♀.

***Brachystegus scalaris* (Illiger, 1807).** *Nysson spinosus*: p. 197: VII, Pancharevo, 1 ♂, misidentified.

****Argogorytes fargeii* (Shuckard, 1837).** *Gorytes quadrifasciatus*: p. 197: VII, Stara Zagora, 2 ♂♂, misidentified.

***Harpactus elegans* (Lepeletier, 1832).** *Harpactus elegans*: p. 197: VI, Pancharevo, 1 ♂, 1 ♀.

***Gorytes quinquecinctus* (Fabricius, 1793).** *Hoplisis fallax*: p. 197: V, Sofia, 1 ♂, misidentified. *Hoplisis quinquefasciatus*: p. 197: VII, Pancharevo, 1 ♂, misidentified.

***Gorytes planifrons* (Wesmael, 1852).** *Hoplisis fallax*: p. 197: VI, Svoge, 1 ♀, misidentified.

***Lestiphorus bicinctus* (Rossi, 1794).** *Lestiphorus bicinctus*: p. 197: VII, Vitoshka Mtn., 1 ♀ (LJUBOMIROV, 2000b).

***Ammatomus coarctatus* (Spinola, 1808).** Unpublished material: VII, Stara Zagora, 3 ♀♀.

***Stizus bipunctatus* (F. Smith, 1856).** *Stizus terminalis*: p. 197: VII, Stara Zagora, 1 ♂.

***Bembecinus tridens* (Fabricius, 1781).** *Stizus tridens*: p. 197: VI, Pancharevo, 2 ♀♀; VII, Pancharevo, 1 ♂.

***Bembix bicolor* (Radoszkowsky, 1877).** *Bembex oculata*: p. 197: Pazardzik, 1 ♀, misidentified.

***Bembix bidentata* (Vander Linden, 1829).** *Bembex bidentata*: p. 196: VII, Bourgas, 3 ♂♂. *Bembex megerlei*: p. 197: V, Sadovo, 1 ♂, misidentified. *Bembex rostrata*: p. 197: VII, Asenovgrad, 1 ♀, misidentified.

***Bembex megerlei* (Dahlbom, 1845).** *Bembex megerlei*: p. 197: VII, Bourgas, 6 ♂♂. *Bembex integra*: p. 197: Bourgas, 2 ♀♀, misidentified.

***Bembex oculata* (Panzer, 1801).** *Bembex oculata*: p. 197: VII, Bourgas, 1 ♀.

***Bembex olivacea* (Fabricius, 1787).** *Bembex mediterranea*: p. 197: Svishtov, 1 ♀; VII, Bourgas, 1 ♂, 1 ♀; Bourgas, 1 ♀. *Bembex oculata*: p. 197: ?VII, Varna, 2 ♀♀, misidentified. Unpublished material: VI, Svoge, 1 ♂.

***Bembix rostrata* (Linnaeus, 1758).** *Bembex rostrata*: p. 197: VI, Svoge, 2 ♂♂; VI, Pancharevo, 1 ♀; VII, Pancharevo, 1 ♀.

***Bembix tarsata* (Latreille, 1809).** *Bembix integra*: p. 197: VI, Svoge, 1 ♂; VI, Vitosha Mtn., 1 ♀ (LJUBOMIROV, 2000b); VII, Varna, 2 ♀♀.

Philanthinae

***Philanthus coronatus* (Thunberg, 1784).** *Philanthus venustus*: p. 198: VI, Iskar Riverside, 1 ♂, misidentified. Unpublished material: 1 ♀, no further data.

***Philanthus triangulum* (Fabricius, 1775).** *Philanthus triangulum*: p. 198: VIII, Stara Zagora, 1 ♂.

***Philanthus venustus* (Rossi, 1790).** *Philanthus venustus*: p. 198: VII, Pancharevo, 1 ♂. *Philanthus coronatus*: p. 198: VII, Bourgas, 1 ♀, misidentified.

***Cerceris bracteata* Eversmann, 1849.** *Cerceris bucculata*: p. 198: VII, Pancharevo, 1 ♀, misidentified.

***Cerceris flavicornis* Brullé, 1833.** *Cerceris conigera*: p. 198: VII, Stara Zagora, 1 ♂.

***Cerceris flavilabris* (Fabricius, 1793).** *Cerceris arenaria*: p. 198: VI, Sofia district, 1 ♂; VIII, Vidin, 1 ♂, misidentified.

***Cerceris interrupta* (Panzer, 1799).** *Cerceris labiata*: p. 198: VII, Pancharevo, 1 ♀.

***Cerceris lunata* A. Costa, 1869.** *Cerceris hortivaga*: p. 198: VII, Stara Zagora, 1 ♂, misidentified.

***Cerceris quadricincta* (Panzer, 1799).** *Cerceris quadricincta*: p. 198: VII, Pancharevo, 1 ♀; Pazardzik, 1 ♂. *Cerceris quadrifasciata*: p. 198: VII, Stara

Zagora, 1 ♂; VI, Pazardzik, 1 ♂, misidentified.

***Cerceris quadrifasciata* (Panzer, 1799).** *Cerceris quadrifasciata*: p. 198: VI, Vitosha Mtn., 1 ♂ (LJUBOMIROV, 2000b).

***Cerceris quinquefasciata* (Rossi, 1792).** *Cerceris arenaria*: p. 198: VII, Pancharevo, 2 ♂♂, misidentified. *Cerceris labiata*: p. 198: VII, Pancharevo, 1 ♀. *Cerceris stratiotes*: p. 198: VII, Pancharevo, 2 ♂♂, misidentified.

***Cerceris rubida* (Jurine, 1807).** *Cerceris rybyensis*: p. 198: VIII, Devnya, 1 ♀, misidentified.

***Cerceris ruficornis* (Fabricius, 1793).** *Cerceris labiata*: p. 198: VII, Pancharevo, 1 ♀. Unpublished material: Sofia, 1 ♂; Pancharevo, 1 ♂; VII, Pancharevo, 1 ♂; VIII, Pancharevo, 1 ♂. All four specimens determined - *Cerceris conigera*.

***Cerceris rybyensis* (Linnaeus, 1771).** *Cerceris rybyensis*: p. 198: VI, Vitosha Mtn., 1 ♂ (LJUBOMIROV, 2000b).

***Cerceris sabulosa* (Panzer, 1799).** *Cerceris rybyensis*: p. 198: VII, Pancharevo, 2 ♂♂; VIII, Stara Zagora, 1 ♂; VII, Haskovo, 1 ♀, misidentified. Unpublished material: VI, Sofia district, 1 ♀, determined - *Cerceris* sp.; VI, Rhodope Mts., 1 ♂, determined - *Cerceris rybyensis*; 2. VI, 1903, Sliven, 1 ♂; VIII, Ichtiman, 1 ♀.

***Cerceris stratiotes* Schletterer, 1887.** *Cerceris stratiotes*: p. 198: VI, Ichtiman, 1 ♀. *Cerceris rybyensis*: p. 198: VI, Ichtiman, 1 ♀, misidentified.

***Cerceris tuberculata* (Villers, 1789).** *Cerceris tuberculata*: p. 198: Elena, 1 ♂.

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Author's address:
Toshko Ljubomirov
Institute of Zoology
1, Tsar Osvoboditel Blvd
1000 Sofia, Bulgaria

**Ревизиран списък на видовете риещи оси
(Hymenoptera: Sphecidae) от сбирката на Н. Негелков
в Националния природонаучен музей в София**

Тoшкo ЛЮБОМИРОВ

(Р е з ю м е)

На базата на прегледания материал от 364 сфещидни екземпляра от сбирката на гимназиалния учител и ентомолог Никола Негелков са направени редица поправки върху публикациите му от 1909 и 1914 година и са представени данни от събиран от този автор материал, които не са били публикувани досега. Съобщените от Негелков 108 вида са сведени до 107 вида от 45 рода.

Зоологическо изследване на Джебел Марра (Дарфур, Судан)

Петър БЕРОН

Изолираната планина Джебел Марра се издига в сред саваната на Дарфур (Западен Судан, близо до границата с Република Чад). Нейната височината е 3042 m (според прецизната германска карта 1 : 100 000 от 1989 г.), но по-старите руски и български карти показват височина 3088 m. Тя е угаснал вулкан, в кратера на който са образувани две езера. Планината се посещава рядко от зоолози, а всъщност е много интересна със своето централно положение в Африка, между аридните планини на Сахара и влажнотропичните планини на Централна и Източна Африка.

Долните части на планината са гъсто заселени и обработени. Отглеждат се сорго, царевица и други култури, планината е прочута със своите плодове, включително ябълки. По-нагоре местната гора е запазена само в недостъпните места, а целият среден пояс до около 2200 m е засаден с 30-40 годишна изкуствена гора от евкалипти и кипарисоподобни дървета. Над тази височина се простира тревиста растителност с единични дървета. До най-високите части (към 3000 m) растат диви маслинови дървета, което е верен индикатор за медитерански климат. Отдавна е отбелязано наличието на много медитерански елементи (вероятно реликтни) във флората на тази планина, разположена в центъра на Африка и далеч от всякакво море. Нейната фауна е доста слабо проучена и това беше една от главните цели на моето посещение там.

От 24 септември до 2 октомври пребивавах в Ниала (пров. Южен Дарфур) и в горския дом Голол (пров. Западен Дарфур) в планината на около 1640 m височина. Пребиваването ми беше осигурено от губернатора на Южен Дарфур чрез Комитета за приятелство с чужбина в Хартум и федералния министър на околната среда. Беше ми предоставен джип и четирима съпровождащи, включително въоръжен полицай. Имах възможност да събера насекоми и други безгръбначни на светлина и под камъни в Ниала и в планината на височина от 1640 до около 3020 m, да пресея значително количество шума в запазената гора около водопада Голол и да уловя няколко прилепа и влечуги. Това е първото българско зоологическо изследване в Судан и едно от редките в Джебел Марра. Зоогеографският анализ на тази островна планина с азонална природна обстановка би бил особено интересен.

Известен материал беше събран и в околностите на Хартум покрай река Нил със съдействието на Природонаучния музей в Хартум. Музеят, чийто директор е бил дълго време видният изследовател на живота в пустинята проф. J. L. Cloudsley-Thompson, е в системата на Хартумския университет, има експозиция и библиотека. Пред колегите от Биологическия факултет беше изнесена лекция върху зоогеографията на Африка.

Cyclopides (Crustacea: Copepoda) des eaux souterraines de Bulgarie: distribution et remarques morphologiques

Ivan PANDOURSKI

Introduction

Cet article présente une partie des résultats des recherches stygobiologiques, effectuées par l'Institut de zoologie à Sofia principalement pendant les dix dernières années. L'échantillonnage faunistique mené au cours de pompage de l'eau de forages d'observation parallèlement avec les prospections hydrogéologiques montre que dans la zone profonde de l'aquifère karstique les cyclopides sont fréquents.

Au total, dans les stations étudiées nous avons établi 28 espèce et sous-espèce. *Mesocyclops leuckarti* se rapporte pour la première fois des eaux souterraines de Bulgarie. En raison de la mauvaise conservation des exemplaires ou du statut taxonomique des certaines espèces stygobies de genre *Diacyclops* ("*languidoides*" - gr.) et de genre *Acanthocyclops* ("*kieferi*" - gr.) insuffisamment éclairci, une partie du matériel n'était pas déterminée au niveau d'espèce.

Matériel et méthodes

Les méthodes d'échantillonnage (MATHIEU et al., 1991) sont:

- filtration des eaux des sources et des rivières souterraines;
- méthode Karaman-Chappuis et méthode Bou-Rouch pour la faune des sédiments saturés;
- méthode de CVETKOV (1968);
- filtration des eaux au cours des pompages de l'eau des forages étudiés.

Le matériel (83 échantillons) provient de 73 stations: 18 sources karstiques, 18 grottes, 23 habitats interstitiels (psammal), 7 puits d'eau douce, 13 galeries artificielles et quatre forage d'observation. Les échantillons ont été fixés dans 4% de

formol et triés sous la loupe binoculaire 16x. Pour la détermination taxonomique les exemplaires étaient diséqués et montés entre lame et lamelle dans glicerine.

La fréquence d'occurrence (pF) de chaque espèce est donnée en pourcent du nombre total des stations étudiées.

Stations prospectées

I. Sources

1. Source karstique près du village de Bălgarski izvor, dép. de Lovetch: 2.12.1993;
2. Petite source avec des mousses humides près du village de Zlatna panega, dép. de Pleven: 2.12.1993;
3. Petite source avec des mousses humides près du village de Roumjantzevo, dép. de Pleven: 2.12.1993;
4. Source captée, ville de Kazanlāk: 8.03.1989 (A. Petrova col.);
5. Source karstique "Žitoľjub" près de la gare de Lakatnik, dép. de Sofia: 23.03.1994;
6. Source karstique sur la rive droite de la rivière Osām près du village de Devetaki, dép. de Lovetch: 4-5.06.1994;
7. Source-fontaine près du monastère "Sveta Troitza", village de Oustrem, la montagne de Sakar: 10.08.1994;
8. Les sources karstiques de la rivière de Mladejka, village de Mladejko, dép. de Bourgas, la montagne de Strandja: 9.08.1994;
9. Source karstique près du village de Lesidren, dép. de Lovetch, débit de 1,5 l/sek: 3-5.10.1994;
10. Source karstique "Popov izvor", village de Bosnek, dép. de Pernik: 25.12.1994;
11. Source karstique près de l'église du village d'Iskretz (le vieux aqueduc), la montagne de Ponor, dép. de Sofia: 9.03.1995, 11.03.1995;
12. Source karstique "Cărna voda", village d'Iskretz, dép. de Sofia: 17.03.1995, 19.03.1995;
13. Source karstique, village de Glavatzi, dép. de Vratza: 22.03.1995 (A. Benderev col.);
14. Source karstique "Belia izvor", ville de Vratza: 22-23.03.1995 (A. Benderev col.);
15. Source karstique, village de Bistretz, dép. de Vratza: 13.04.1995 (A. Benderev col.);
16. Source karstique-fontaine au lieu-dit "Garvanov dol", village de Sadovetz, dép. de Pleven: 30.06.1996;

II. Grottes

17. Gours dans la grotte "25 anniversaire d'Academic" ("Barkite 18"), village de Gorno Ozirovo, la montagne de Vratza: 12.06.1993;

18. Ruisseau et gours dans la grotte "Barkite 14", village de Gorno Ozirovo, la montagne de Vratza: 11.06.1993;

19. Ruisseau dans la grotte "Devetachkata pechtera", village de Devetaki, dép. de Lovetch: 5.06.1994;

20. Gours dans la grotte "Balduinovata pechtera", village de Lesidren, dép. de Lovetch: 4.10.1994;

21. Gours et ruisseau dans la grotte "Lepenitza", ville de Velingrade, les Rhodopes: 16.10.1994;

22. Flaques dans la grotte "Katzite", village de Zimevitza, dép. de Sofia, la montagne de Ponor: 25.04.1995;

23. Gours dans la grotte "Ljastovitzata", village de Gložene, dép. de Lovetch: 22.02.1995;

24. Flaques et gours dans la grotte "Douchnika", village d'Iskretz, dép. de Sofia, la montagne de Ponor: 17.03.1995;

25. Grotte-source "Doupkata", village de Beli izvor, dép. de Vratza: 30.08.1995 (A. Benderev col.);

26. Flaques et petits lacs en période de basse eau dans la grotte "Goljamata Balabanova pechtera", village de Gintzi, la montagne de Stara Planina Occidentale: 6.12.1992, 15.10.1995;

27. Gours dans la grotte "Desni souhi petch", village de Dolni Lom, dép. de Vidin: 4.04.1996;

28. Ruisseau dans la grotte "Skokă", village de Dragana, dép. de Pleven: 30.06.1996;

29. Gours dans la grotte "Toplja", village de Goljama Želzna, dép. de Lovetch: 19.01.1992;

30. Gours dans la grotte "Svetata voda", village de Gintzi, dép. de Sofia: 27.03.1993;

31. Gours dans la grotte "Grimnina doupka", village de Tcherkaski, dép. de Vratza: 25.11.1996;

32. Ruisseau dans la grotte "Sedlarkata", village de Rakita, dép. de Pleven: 22-23.05.1997;

33. Gours dans la grotte "Ražichkata pechtera" ("Souhata"), gare de Lakatnik, dép. de Sofia: 24.07.1997;

III. Eaux interstitielles (psammal)

34. Rivière Veleka, lieu-dit "Katchul", la montagne de Strandja: 27.10.1972 (A. Petrova and L. Cvetkov col.);

35. Rivière Vedena, lieu-dit "Djavolski most", dép. de Sofia: 24.03.1994;

36. Rivière Iskăr, Gorubljane, Sofia: 24.03.1994;

37. Rivière Iskär, lieu-dit "Djavolski most", dép. de Sofia: 24.03.1994;
38. La zone des sources "Iskretzki" (sable et gravier), village d'Iskretz, dép. de Sofia: 23.03.1994, 25.07.1994;
39. Rivière Popovska, village de Raduntzi, dep. de Stara Zagora, la montagne de Stara Planina: 26.06.1994;
40. La rivière près du village de Velinovo, dép. de Pernik: 26.08.1994;
41. Ruisseau Smlenski dol, village de Lesidren, dép. de Lovetch: 4.10.1994;
42. Rivière Proboïnitza, gare de Lakatnik, dép. de Sofia: 25.04.1994, 25.07.1994;
43. Rivière Tcherni Iskär, village de Mala Tzärkva, dép. de Sofia, la montagne de Rila: 26.07.1994;
44. Rivière Beli Iskär, village de Beli Iskär, dép. de Sofia, la montagne de Rila: 26.07.1994;
45. Rivière Iskär, village de Dragouchinovo, dép. de Sofia: 25.03.1994, 26.07.1994;
46. Rivière Batoulijska, village de Batoulia, dép. de Sofia: 25.07.1994;
47. Rivière Iskär, gare Lakatnik, dép. de Sofia: 25.04.1994;
48. Rivière Iskretzka, village d'Iskretz, dép. de Sofia: 25.07.1994;
49. Rivière Kriva reka, village de Beledie Kchan, dép. de Sofia: 2.08.1995;
50. Rivière Palakarija, village de Chiroki dol, dép. de Sofia: 24.11.1994;
51. Petit ruisseau, village de Lechko, dép. de Blagoevgrad, la montagne de Vlachina: 8.06.1996;
52. Rivière Iskär, lieu-dit "Leskov dol", dép. de Sofia: 17.08.1989;
53. Rivière Rilska reka, lieu-dit "Elechnitza", village de Pastra, la montagne de Rila: 23.08.1997;

IV. Puits d'eau douce

54. Ville de Kazanlāk: 8.03.1989 (A. Petrova col.);
55. Village de Polsko Kosovo, dép. de Rousse: 10.05.1969 (A. Petrova and L. Cvetkov col.);
56. Ville de Zlataritz: 12.05.1969 (L. Cvetkov col.);
57. Puits dans la terrasse d'alluvium de la rivière Kozle, village de Zavidovtzi, dép. de Sofia: 23.03.1994;
58. Village de Novgrad, dép. de Rousse: 8.01.1969 (L. Cvetkov col.);
59. Ville de Gabrovo, quartier Chenini, profondeur -14 m: 22.04.1995;
60. Sofia, quartier Bākston, profondeur -3 m: 21.04.1995;

V. Galeries artificielles

61. Ruisseau souterrain, lieu-dit "Sirichtna", village de Metcha poljana, dép. de Sofia, la montagne de Ponor: 10.12.1993, 25.11.1995;
62. Flaques dans une galerie située sur la rive droite de la rivière Proboïnitza, gare de Lakatnik, dép. de Sofia: 30.03.1994, 4.04.1995;
63. Petites flaques d'une galerie creusée dans des calcaires, village de Gorna Bela retchka, la montagne de Vratza: 13.03.1994;

64. Mine d'uranium au lieu-dit "Kirilova poljana", la montagne de Rila: 8.02.1995, 5.10.1995;
65. Flaques et gours dans une galerie dans des granites près de la ville de Rila, la montagne de Rila: 8.02.1995, 5.10.1995;
66. Petits lacs dans la galerie près du quartier Stoudena, la ville de Pernik: 8.02.1995;
67. Flaques dans une galerie dans des calcaires au lieu-dit "Smesito", village de Tcherni Osām, dép. de Lovetch: 23.02.1995;
68. Gours dans une galerie au lieu-dit "Ourvitch", dép. de Sofia: 24.11.1994;
69. Ruisseau souterrain dans une galerie sous le sommet "Izdremetz", la montagne de Stara planina: 17.01.1997;

VI. Forages d'observation

70. Forage (profondeur -250 m) dans des calcaires, pompage d'eau (12 heures avec débit de 1 l/s), village de Roumjantzevo, dép. de Pleven: 25.12.1993;
71. Forage dans des calcaires, village de Beli izvor, dép. de Vratza: 6.07.1995 (A. Benderev col.);
72. Village de Roumjantzevo, dép. de Pleven: 5.04.1996 (S. Vesselinov col.);
73. Village de Toros, dép. de Pleven: 10.04.1996 (S. Vesselinov col.).

Composition taxonomique

CYCLOPOIDA

Cyclopidae

Eucyclopinae

Macrocyclops albidus (Jurine, 1820): 6, 25; pF = 2,7%.

Eucyclops serrulatus (Fischer, 1851): 1, 3, 6, 8, 9, 10, 21, 38, 66, 71; pF = 13,7%.

Paracyclops fimbriatus fimbriatus (Fischer, 1853): 2, 3, 4, 6, 8, 9, 15, 16, 18, 21, 25, 26, 30, 37, 48, 52, 54, 55, 62, 67, 68, 69, 72; pF = 31,5%.

Paracyclops fimbriatus (Fischer, 1853) (s. lat.): 7, 39; 51; pF = 4,1%.

Paracyclops poppei (Rehberg, 1880): 45, 71; pF = 2,7%.

Cyclopinae

Cyclops strenuus strenuus (Fischer, 1851): 14, 21; pF = 2,7%.

Cyclops sp.: 45, 54; pF = 2,7%.

Acanthocyclops vernalis vernalis (Fischer, 1853): 13, 21, 25, 32, 49, 71; pF = 8,2%.

Acanthocyclops propinquus (Plesa, 1957): 36, 65; pF = 2,7%.

Acanthocyclops iskrecensis Pandourski, 1992: 38, 61; pF = 2,7%.

Acanthocyclops balcanicus Naidenow & Pandourski, 1992: 9; pF = 1,4%.

Acanthocyclops strimonis (Pandourski, 1994): 21, 43; 66; pF = 4,1%.

Acanthocyclops radevi Pandourski 1993: 11, 12; pF = 2,7%.

Acanthocyclops sp. ("kieferi" gr.): 11, 12, 38, 72; pF = 5,5%.
Megacyclops viridis (Jurine, 1820): 9, 13, 14, 16, 22, 24, 26, 28, 29, 35, 43, 45, 48, 56; pF = 19,2%.
Diacyclops bisetosus (Rehberg, 1880): 45, 47, 60, 71; pF = 5,5%.
Diacyclops crassicaudis crassicaudis (Sars, 1863): 42; pF = 1,4%.
Diacyclops fontinalis Naidenow, 1969: 54; pF = 1,4%.
Diacyclops languidus languidus (Sars, 1863): 41, 45, 73; pF = 4,1%.
Diacyclops languidoides languidoides (Lilljeborg, 1901): 5, 13, 25, 36, 37, 40, 43, 44, 57, 58, 59, 62, 64; pF = 17,8%.
Diacyclops languidoides (Lilljeborg, 1901) (s. lat.): 12, 14, 19, 34, 35, 38, 53, 55, 56, 70, 71, 73; pF = 16,4%.
Diacyclops pelagonicus saetosus Pandourski, 1993: 24; pF = 1,4%.
Diacyclops c.f. *clandestinus* (Kiefer, 1926): 6, 7, 9, 36, 42, 48; pF = 8,2%.
Diacyclops sp. ("languidoides" gr.): 46, 50; pF = 2,7%.
Diacyclops sp.: 4, 26, 35, 52, 54; pF = 6,8%.
Graeteriella unisetigera (Graeter, 1910): 38; pF = 1,4%.
Speocyclops infernus (Kiefer, 1930): 17, 18, 20, 23, 29, 33, 63; pF = 9,6%.
Speocyclops c.f. *infernus* (Kiefer, 1930): 67; pF = 1,4%.
Speocyclops lindbergi Damian, 1957: 27, 31; pF = 2,7%.
Mesocyclops leuckarti (Claus, 1857): 35; pF = 1,4%.
Metacyclops minutus (Claus, 1863): 71; pF = 1,4%.

Remarques morphologiques

Acanthocyclops sp. ("kieferi" - groupe) (fig. 1)

Dans les eaux souterraines karstiques de la montagne de Ponor nous avons trouvé des exemplaires, qui sans doute appartiennent au groupe d'espèce "kieferi" du genre *Acanthocyclops*. Ces exemplaires sont très rares dans les échantillons. Lors du filtrage continu de l'eau des sources karstiques aux environs du village d'Iskretz, leur nombre ne dépasse pas un ou deux individus. Ce matériel restreint ne nous permet pas de faire une description complète de cette espèce. Ci-dessous nous donnons courtes remarques morphologiques, accompagnées de dessins (fig. 1).

Matériau: 1 femelle, 10.04.1995; station 11; 1 mâle, 17.03.1995; station 12.

Description.

Femelle. Longueur du corps (sans les soies apicales furcales): 0,67 mm. Antennules de 11 articles, courtes, ne dépassent pas le bord postérieur de céphalosome. Antennes de 4 articles, sans exopodite. Formule des pattes nata-toires P1-P4: 3.2/3.2/3.3/3.3. L'article distal de 3enp.P4 1,2 fois plus que large avec une épine apicale interne 1,38 fois plus longue que l'externe et 1,32 fois plus longue que l'article. P5 avec une épine subapicale courte. Branches furcales 2,78 fois plus longues que larges; les soies apicales internes et externes égales et un

A - C 0.05 mm

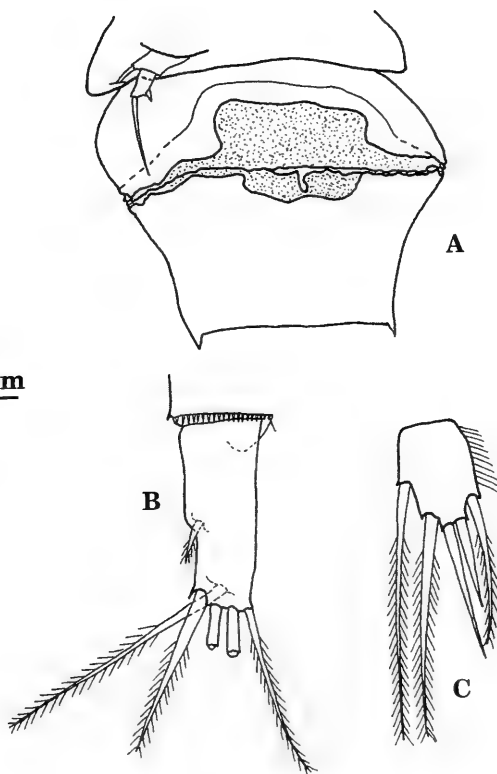


Fig. 1. *Acanthocyclops* sp. ("kieferti" - groupe) (femelle): A - segment génital, réceptacle séminal et P5; B - branche furcale, ventral; C - 3 endopodite de P4

peu plus courtes que les branches furcales. Soie dorsale relativement longue: 0,07 mm. Segment génital plus large que long (0,83/1).

Mâle. Longueur du corps (sans les soies apicales furcales): 0,56 mm. La forme générale du corps, l'articulation des pattes natatoires et les rapports entre les plus importants caractères morphologiques lineaires se rapprochent de ceux des femelles. Antennules de 15 articles.

Discussion. Les exemplaires étudiés, appartenants au groupe d'espèce "kieferti" du genre *Acanthocyclops*, se distinguent de tous les représentants de ce groupe par les caractères suivants: soies apicales furcales internes et externes égales et relativement longues; l'épine apicale interne sur l'article distal de l'endopodite de P4 plus longue que l'article; les antennules chez les mâles de 15 articles.

Mesocyclops leuckarti (fig. 2)

Matériel: 1 femelle, 24.03.1994; station 35.

Jusqu'à présent, *M. leuckarti* est trouvé une seul fois dans les eaux souterraines de Bulgarie: l'interstitiel de la terrasse alluviale de Vedena aux environs de Sofia. La seule femelle se distingue du matériel décrit d'Ukraine (MONCHENKO,

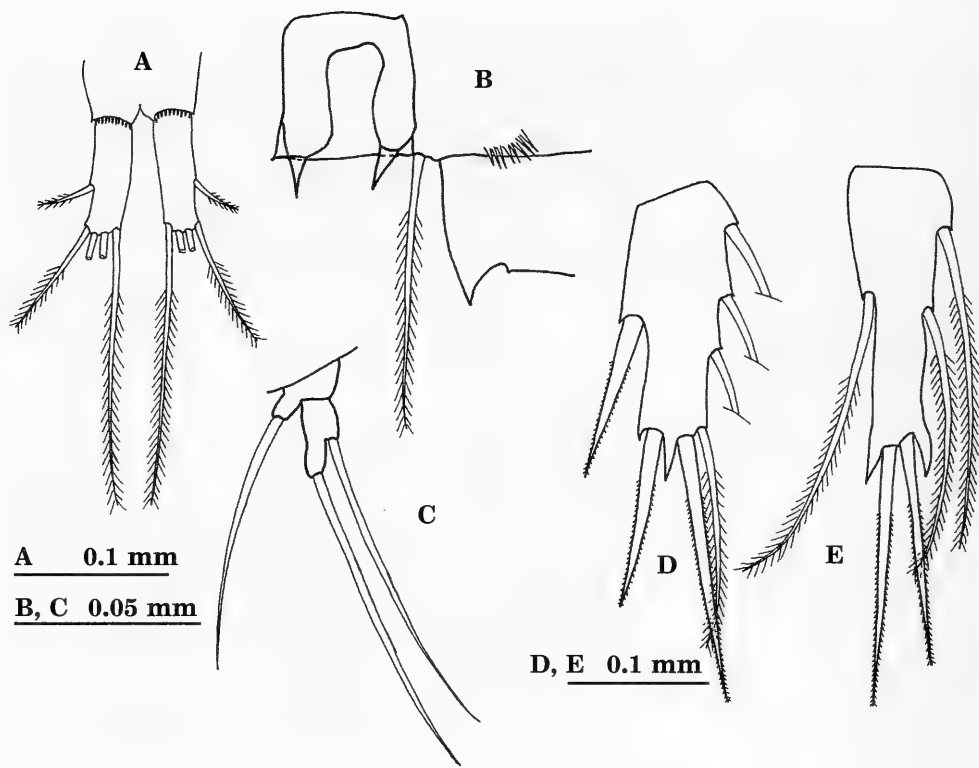


Fig. 2. *Mesocyclops leuckarti* (Claus) (femelle): A - branches furcales; B - plaque intercoxale de P4; C - P5; D - 3 exopodite de P4; E - 3 endopodite de P4.

1974) par des plus longues soies sur l'article basal et l'article distal de P5. Le réseptacle séminal n'était pas clairement visible. Fig. 2 illustre les caractères morphologiques de valeur taxonomique de l'exemplaire étudié.

Discussion

Parmi les 28 espèce et sous-espèce établies, douze sont stygobies des genres *Acanthocyclops*, *Diacyclops*, *Graeteriella* et *Speocyclops*. Parmi les autres, que nous pouvons considérer comme stygofiles, les formes typiques de *P. fimbriatus* (pF = 31,5%) et de *D. languidoides* (pF = 17,8%) et *E. serrulatus* (pF = 13,7%) sont les plus fréquents dans des habitats étudiés.

Jusqu'à présent *A. iskrecensis* n'était connu que des eaux souterraines du bassin karstique d'Iskretz (la partie occidentale de la chaîne de la montagne de Stara planina en Bulgarie) (PANDOURSKI, 1992a; 1994). La grotte Lazareva pečina près du Zlot, la montagne de Kučaj est la première station de l'espèce en

Yugoslavie (PANDOURSKI & BOBIĆ, sous presse). La caractéristique morphologique des spécimens étudiés de Zlot recouvre la morphologie des exemplaires de Bulgarie. Ce fait montre que dans les différentes parties de son aire de distribution les caractères morphologiques d'*A. iskrecensis* sont bien définis.

La grotte Lazareva pečina est la localité-type pour *Acanthocyclops stygius* (CHAPPUIS, 1924). Malgré nos efforts nous n'avons pas retrouvé cette espèce dans les gours et dans les deux lacs de syphon dans cette grotte. Le résultat était aussi négatif dans les gours des grottes voisines: Mandina, Chajdutchitza, Vodena, et Vernikitzza.

Deux formes sont aussi décrites comme sous-espèces: *A. stygius diminutus* (Chappuis, 1925) et *A. stygius macedonicus* (Petkovski, 1954). Ces sous-espèces d'après PANDOURSKI (1997) ont un statut d'espèce et appartiennent au groupe d'espèce "*kieferi*" du genre *Acanthocyclops*.

DAMIAN-GEORGESCU (1963) annonce *A. stygius* pour Roumanie et Hongrie. En Bulgarie, les spécimens attribués à cette espèce (PETROVA et al., 1986) ont été déterminés par Dr. W. Naidenow. Malheureusement aucune description ni illustration ne sont données et à notre avis le statut taxonomique de ce matériel est incertain. Chez PANDOURSKI (1992b) il s'agit d'exemplaires jeunes, pêchés morts, ou présentant un mauvais état, dont la détermination exacte était impossible. Néanmoins, en tenant compte de certains critères morphologiques ce matériel se rapporte au groupe "*kieferi*" du genre *Acanthocyclops* (sensu PANDOURSKI, 1997).

Acanthocyclops iskrecensis diffère nettement de *A. stygius* par plusieurs caractères morphologiques d'une valeur taxonomique: rapports entre les longueurs des soies apicales furcales, l'ornementation avec des soies des endopodites P1-P4, la forme générale de P5. Malheureusement Chappuis n'a pas conservé le matériel-type de *A. stygius* et leur description (CHAPPUIS, 1924) est très schématique.

Jusqu'à présent, *Acanthocyclops balcanicus*, *A. strimonis*, *A. radevi*, *Diacyclops fontinalis* et *D. pelaginicus saetosus* ne sont établis que des eaux souterraines de Bulgarie. Remarques sur le statut taxonomique de *D. fontinalis* nous donnons dans un article précédent (PANDOURSKI, 1997).

Remerciements

Je remercie le Mr L. Prekroutov (Iskretz, Bulgarie) qui a recolté une partie du matériel des eaux souterraines de la montagne de Ponor et pour son aide sur le terrain.

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Adresse de l'auteur:
Dr. Ivan Pandourski
Institut de zoologie
Boul. Tzar Osvoboditel 1
1000 Sofia, Bulgarie

Циклонуги (Crustacea: Copepoda) от подземните води на България: разпространение и морфологични бележки

Иван ПАНДУРСКИ

(Резюме)

Съобщават се 28 вида и подвиги от семейство Cyclopidae, събрани от подземни води в 73 станции: 18 карстови извора, 18 пещери, 23 в интерстициални алувиални води (псамал), 7 кладенеца, 13 изкуствени галерии и мини и 4 геоложки сондажа. *Mesocyclops leuckarti* (Claus) се съобщава за първи път от подземни води в България. Дванадесет вида и подвиги са стигобионти от родовете *Acanthocyclops*, *Diacyclops*, *Speocyclops* и *Graeteriella*. Направена е морфологична характеристика на мъжки и женски екземпляри от досега неизвестен подземен вид от видовата група "kieferei" на род *Acanthocyclops*, но поради липса на достатъчно материал не е описан с ново видово име.

Морфологичният анализ на популации на *Acanthocyclops iskrecensis* Pandourski, както от подземните води на Западна Стара планина, така и от карстовите води на планината Кучай в Източна Сърбия, показва, че видът има добре обособени и сравнително постоянни морфологични белези в различните разкъсани части на своя ареал.

Encyclopaedia biospeologica - събитие в биоспелеологията

Петър БЕРОН

JUBERTHIE Ch., V. DECU (eds). Encyclopaedia biospeologica. Moulis - Bucarest. I (1994, 834 p.), II (1998, 539 p.).

През последното десетилетие на 20 век се осъществи мечтата на поколения биоспелеолози - да имат събрани в енциклопедия знанията върху пещерната фауна на света. С тази титанична задача се наеха двамата добре познати колеги - французинът Кристиан Жюберти, който в течение на много години ръководеше Подземната лаборатория в Мулис, и румънецът Василе Деку от Института по спелеология "Емил Раковица" в Букурещ. Те организираха голям екип от най-добрите специалисти по отделни групи животни и страни и досега са публикували два тома (през 1994 и 1998 г.) с общо 1373 страници голям формат на френски и английски език. В първия том са включени 103 статии върху пещерни обитатели (нисуши животни, Crustacea, Arachnida, Myriapoda, Apterygota и Pterygota), върху бактериите и водораслите в пещерите и върху пещерната фауна на 58 страни от Европа, Северна, Централна и Южна Америка. Той включва и статия за българската пещерна фауна (В. Георгиев, Хр. Делчев и В. Големански). Томът започва със статията на В. Големански и L. Bonnet за пещерните протозои. За всяка страна или група организми е посочена основната литература и най-новите постижения в нейното изследване, приложени са карти на карстовите области и рисунки на много от най-типичните пещерни обитатели. Тази система е продължена и във втория том, който обхваща още 35 статии върху други групи безгръбначни и върху гръбначните животни, върху паразитните гъби, лишеите, мъховете, папратите и "ламповата флора". Има и една статия върху псевдокарста като местообитание. Очевидно ще е необходим и трети том, тъй като не са публикувани досега статии за карста, пещерите и пещерната фауна в Африка, Азия и гр.

По своя обхват Биоспелеологичната енциклопедия далеч надхвърля всичко правено досега в областта на биоспелеологията. Досегашните опити за обобщения на биоспелеологичните знания на A. Vandel през 1964 г. и на R. Ginot и V. Desu през 1977 г. бяха много полезни, но с бурното развитие на изследванията, главно върху пещерната фауна на тропиците, стана вече невъзможно за един човек да обхване на нивото на специалист всичко известно. Енциклопедията представя най-новите знания за слабо познати или новооткрити групи животни: Remipedia, Moustacea, Sphelaeogriffasea и гр., както и обобщения за страни, чиято пещерна фауна е по-слабо позната на европейците (Централна и Южна Америка, а в третия том вероятно и на Африка, Азия и Австралия). Поздравяваме нашите колеги с това постижение.

***Xylocoris formicetorum* (Boheman, 1844)
(Heteroptera: Anthocoridae), a new member of
the myrmecophilous fauna of the Balkan
Peninsula**

Albena LAPEVA, Nikolay SIMOV

Xylocoris formicetorum was found during an investigation of the myrmecophilous fauna in the nests of *Formica* in Vitosha and Rila mountains. That fact is interesting because of its geographic position which is far away from the borders of the former areal known up to now.

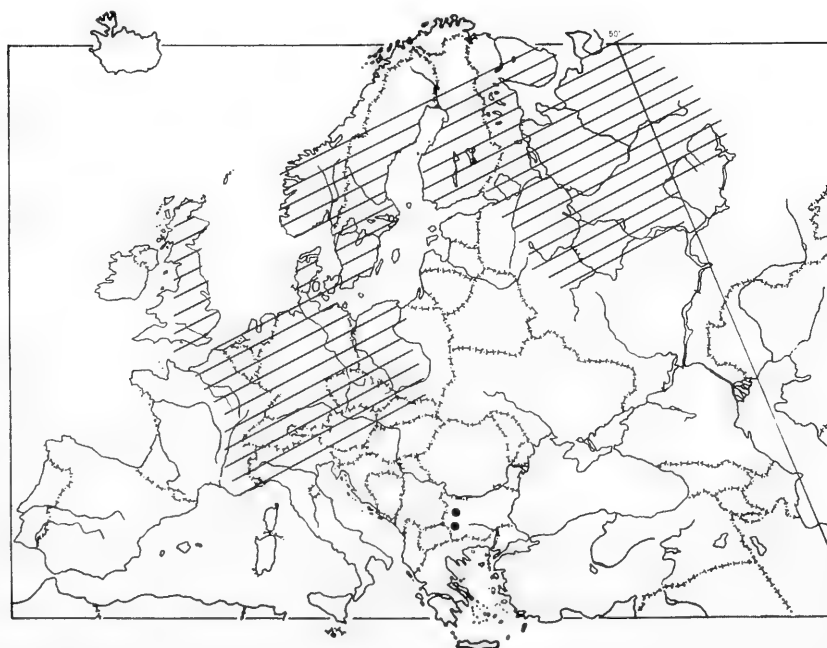


Fig. 1. Distribution of *Xylocoris formicetorum* in Europe
▨ - after PÉRICART (1972); ● - Bulgarian localities

X. formicetorum is a boreal species distributed in Central Europe, Great Britain, the European part of Russia and Scandinavia where it is found even far beyond the polar circle. The species has not been reported from the Balkan Peninsula ever since (JOSIFOV, 1986).

X. formicetorum is an obligatory myrmecophil, being the only member with such characteristics of the family Anthocoridae known in Europe. Most commonly it has been found in the nests of *Formica rufa* L., but there are data of occurrence in the nests of other species of Formicidae - *Formica execta* Nyl, *F. sanguinea* Latr., *F. truncicola* Nyl, *Lasius flavus* (F.) (PÉRICART, 1972), *F. fusca* L. (WAGNER, 1961). It could be found in every part of the nest throughout the whole season (PÉRICART, 1972).

The species was found in Bulgaria in nests of *Formica rufa* and *F. pratensis* Retz. in Rila and Vitosha mountains at altitudes from 1000 to 1850 m above sea level, during the period of April till November. It is possible to find it in some more southern regions of the country where there are suitable conditions such as high altitude and localities of *F. rufa* and *F. pratensis*, as for example Pirin Mts, the Rhodopes, Slavyanka and Belasitsa mountains. The locality in Rila Mts is the most southern point of distribution of the species in Europe known up to now.

Material

Xylocoris formicetorum (Boheman, 1844)

In nests of *Formica rufa*

West Bulgaria, Vitosha Mts: 59 specimens, 6. 10. 1998, Tsvetni Polyani, 1650 m; 11 specimens, 2. 9. 1998, Goli Vrah, 1850 m; 17 specimens, 25. 10. 1998, above Simeonovo Village, 1600 m.

Southwest Bulgaria: Rila Mts, 32 specimens, 24. 7. 1998, Panichishte, 1400 m.

In nests of *Formica pratensis*

West Bulgaria, Vitosha Mts, Bistritsa Village, 1000 m: 11 specimens, 20. 6. 1997; 31 specimens, 14. 11. 1999; 19 specimens, 29. 4. 1998.

The material was collected by A. Lapeva and D. Gradinarov, and determined by N. Simov. Deposited at the Institute of Zoology, Sofia.

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Author's addresses:

Albena Lapeva

Sofia University, Department of Biology

8, Dragan Tsankov Blvd

1421 Sofia, Bulgaria

Nickolay Simov

29, Tundja Str.

1463 Sofia, Bulgaria

***Xylocoris formicetorum* (Boheman, 1844)
(Heteroptera: Anthocoridae) - нов представител на
мирмекофилната фауна на Балканския полуостров**

Албена ЛАПЕВА, Николой СИМОВ

(Р е з ю м е)

Съобщено е за пръв път намирането на *Xylocoris formicetorum* (Boheman, 1844) (Heteroptera, Anthocoridae) на Балканския полуостров - в България (Витоша и Рила) в гнезда на *Formica rufa* и *F. pratensis* (Hymenoptera: Formicidae).

Определител на водните кончета (Odonata) в България от Милен Маринов

Алекси ПОПОВ

МАРИНОВ М. [2000]. Джобен полеви определител на водните кончета на България. С., Ешна. 104 с.



Определителят на водните кончета е една от все още редките у нас, но много необходими книги за насекоми, съдържащи достатъчна по обем информация и голям брой цветни рисунки и същевременно предназначени за по-широк кръг природолюбители. И досега читателите имаха на разположение една сериозно и сполучливо разработена монография на разред Odonata в България (БЕШОВСКИ В. 1994. Insecta, Odonata. - В: Фауна на България. 23. С., Изд. БАН. 372 с.; вж рецензия от ПОПОВ А. 1995. Нов том от поредицата "Фауна на България". - Hist. nat. bulg., 5: 28). Определителят обаче не дублира "Фауната", а основното му достойнство е неговата презледност и удобство при ползване. Състои се от кратка обща част, илюстрирана определителна таблица и характеристика на видовете (наречена описание). Схематичните цветни рисунки са много сполучливи и показват важните и лесни за разпознаване таксономични белези. Другото достойнство на книгата са картите на разпространението на всеки вид в

България със значителен брой оригинални данни, някои от които много интересни.

Разгледани са всички 66 вида в България, включително и установените у нас през последните три години *Chalcolestes parvidens* (Artob.), *Somatochlora meridionalis* (Niels.) и *Selysiothemis nigra* (van der Lind.), първите два намерени от М. Маринов. Значението на определителя нараства, защото българската фауна съдържа някои особено характерни видове. Като такива мога да посоча извънредно интересните в зоогеографско отношение *Epallage fatime* (Charp.), *Aeshna subarctica* Walk., *Cordulegaster heros* Theisch. (не Theish., както е в книгата). Разредът съдържа и редица консервационно значими видове, включени в международни червени списъци (Световна червена книга, Бернска конвенция, CORINE), каквито са *Leucorrhinia pectoralis* (Charp.), видовете от семейство Gomphidae, част от видовете от род *Coenagrion*. Pegku (и вероятно уязвими) у нас са част от посочените видове, както и *Chalcolestes viridis* (van der Lind.), *Lestes macrostigma* (Eversm.), *Somatochlora flavomaculata* (van der Lind.).

Допуснати са някои несъществени пропуски, каквито не могат да бъдат избягнати при отпечатването на една книга. В определителната таблица (с. 18) текстовете за дускоидалната клетка трябва да бъдат "крилен правоъгълник" при Platysnemididae и "крилен трапец" при Coenagrionidae и Lestidae, а те са разменени, докато рисунките са правилно разположени. Също в определителната таблица (с. 25) са пропуснати названията на *Gomphus vulgatissimus* (L.) и *Gomphus flavipes* (Charp.). Дължината на тялото за *Hemianax ephippiger* (Burm.) и *Orthetrum coerulescens* (Fabr.) на с. 66 и 84 е взета безкритично от "Фауната" на г-р В. Бешовски, където е дадена погрешно. *Sympetrum sanguineum* (Müll.) е изписан неправилно като *S. sanguineum* (с. 4, 92, 93). Цитираната на с. 9 публикация на Conci & Nielsen не е от 1935, а от 1956. Мисля, че би било в интерес на природолюбителите в определителя да се споменат и семействата водни кончета, тъй като те са морфологично добре обособени.

Целта на автора е да приобщи по-широк кръг хора към опознаването, проучването и опазването на водните кончета у нас. Тази цел е постигната чрез доброто качество на книгата и с достатъчния тираж. Поздравления заслужават М. Маринов за създаването на определителя и Британското посолство за финансиране на отпечатването му.

Review of Anthicidae (Coleoptera) from Bulgaria

Gerhard UHMANN, Borislav GUÉORGUIEV

Introduction

Until recently coleopterous insects from the family Anthicidae resident in Bulgaria were not part of special studies. The first written records were from the beginning of 20th century - IOAKIMOV (1904) - 5 species, ANONYMOUS (1907) - 5 species, MARKOVICH (1909) - 3 species, NEDELKOV (1909) - 7 species, PIC (1911) - 1 species and RAMBOUSEK (1912) - 2 species. A single specimen collected near Kavarna was published as *Anthicus* sp. (MÜLLER, 1929: 176). Later, in the middle of the century, Anthicidae data were reported in the following works: ROUBAL (1931-1933) - 8, PANIN (1941) - 3, KARNOSCHITZKI (1950) - 5, KARNOSCHITZKI (1954) - 3, ANGELOV (1964) - 1 and PALM (1966) - 3 species. In more recent times faunistic data concerning these beetles can be found in the publications of UHMANN (1985; 1989) where 12 and respectively 17 species from Bulgaria were reported.

Material and methods

Important information concerning the bibliography and distribution of Anthicidae in Bulgaria was discovered by the second author among the notes of the deceased Bulgarian coleopterologist Vassil Guéorguiev. The most important data were included in a list titled - "Coleoptera, Anthicidae aus Bulgarien" sent to V. Guéorguiev by Dr. F. Hieke on 8.II.1984. The list comprises faunistic data for 23 species, collected by the German zoologists Dr. F. Hieke, Dr. M. Uhlig, Dr. H. Wendt, Dr. U. Göllner, Dr. B. Schülke and Dr. W. Braasch (all from Berlin) in the course of their visits to Bulgaria in the period of 1973-1983. Throughout 1983-1984 all that material was determined by the first author, an Anthicidae specialist since 1972. Two single records, concerning the collections of *Notoxus monoceros* L. (leg. Hoberland) in the East Rhodope Mts. and *Cyclodinus fatuus* (leg. Palm) from Zlatni Pyasatsi, were also added there, but not among the mentioned above list. Until now the whole amount of material preserved in the Museum für

Naturkunde (Berlin), excluding the only one specimen of *Cyclodinus fatuus* keeps in the Museum of Lund, have not been published. An important part of the archive notes was an attempt of V. Guéorguiev for faunistic and nomenclatural assignment on the basis of the literature published on the group from Bulgaria. Due to the joint efforts of both authors it was possible to build a complete illustration of Anthicidae in Bulgaria.

List of the species

Notoxus appendicinus Desbrochers - UHMANN, 1985: 177; UHMANN, 1989: 378; new data: Kozhuh, Hieke (8 ex.); likely xerophil; Spain, Majorca, South France, Italy, Corsica, Sardinia, Slovakia, Hungary, Russia, Balkan Peninsula, Crete, Romania, Turkey, Syria, Iran, Central Asia, Tunisia.

Notoxus brachycerus (Faldermann) - ANONYMOUS, 1907: 321; new data: Kozhuh, Hieke (9 ex.); xerophil; Central and South Europe, Turkey, Kazakhstan.

Notoxus miles Schmidt - ROUBAL, 1933: 144; new data: Predela Pass, Pirin Mt., 1100 m, Uhlig (8 ex.); 2 km N Kresna, Hieke (1 ex.); 10 km W Zemen, Hieke (3 ex.); xerophil, ripicol; Hungary, Romania, Bosna and Hercegovina, Albania, Bulgaria, Turkey.

Notoxus monoceros (Linne) - MARKOVICH, 1909: 20; NEDELKOV, 1909: 7; ROUBAL, 1931: 453; UHMANN, 1989: 378; new data: 10 km W Zemen, Hieke (1 ex.); coomb Vibitsa, Momchilovgrad, East Rhodope Mts., 22.VI.1961, Hoberland (1 ex.); V-VIII; xerophil, dry meadow land, psammophil; Northern and Central Europe, Russia, Northern Spain, Roumania, Bulgaria, Central Asia.

Notoxus trifasciatus Rossi (= *N. cornutus* F.) - ANONYMOUS, 1907: 321 (sub *N. cornutus* F.); NEDELKOV, 1909: 7; ROUBAL, 1931: 453 (sub *N. cornutus* F.); ANGELOV, 1964: 312 (sub *N. cornutus* F.); UHMANN, 1985: 179; UHMANN, 1989: 379; new data: 2 km S Tsarevo, Uhlig (1 ex.); Sozopol, Uhlig (1 ex.); Kozhuh, Hieke (4 ex.); river Blagoevgradska Bistritsa, 800 m, Hieke (1 ex.); 2 km N Kresna, Hieke (2 ex.); 10 km W Zemen, Hieke (1 ex.); V-VI; xerophil, dry sand and grit; Central and Southern Europe, Turkey.

Mecynotarsus fausti Seidlitz - ROUBAL, 1932: 129; KARNOSCHITZKI, 1954: 25-26; UHMANN, 1989: 379; new data: Kozhuh, Hieke (16 ex.); Tsarevo, Hieke & Uhlig (5 ex.); psammophil; Corsica, Sardinia, Sicily, Romania, Balkan Peninsula, Russia.

Mecynotarsus serricornis (Panzer) (= *M. rhinoceros* F.) - ANONYMOUS, 1907: 321 (sub *M. rhinoceros* F.); stenotop, psammophil, nebricol; Central and South Europe.

Pseudotomoderus compressicollis Motschulsky - new data: Primorsko, Hieke & Uhlig (1 ex.); ecological remarks: unknown; Mediterranean (incl. Balkan Peninsula and Georgia) to Mozambique and Namibia. **New genus and species for Bulgaria.**

Formicomus pedestris (Rossi) - IOAKIMOV, 1904: 42; NEDELKOV, 1909: 7; ROUBAL, 1931: 453; PANIN, 1941: 552; UHMANN, 1985: 183; UHMANN, 1985: 183 (sub *F. p. var. atratulus* Reitter); UHMANN, 1989: 382; new data: 2 km S Tsarevo, Uhlig (7 ex.); Melnik, Wendt & Göllner (8 ex.); camp Kavatsite, Göllner (1 ex.); Kozhuh, Hieke (1 ex.); 4 km NW Kresna, Hieke (1 ex.); Kazanlak, Hieke & Uhlig (4 ex.); river Ropotamo, 5 km W Yasna Polyana, Hieke & Uhlig (5 ex.); Tsarevo, Hieke & Uhlig (17 ex.); IV-VII; thermophil, phytodetriticol; Central and Southern Europe, Russia, Turkey, Syria, Azerbaidzhan.

Leptaleus chaudierei (Kolenati) - RAMBOUSEK, 1912: 57 (sub *Anthicus c.* Kol.); ecological remarks: unknown; Balkan Peninsula, Cyprus, Turkey, Iran, Turkmenistan.

Cyclodinus coniceps (Marseul) - KARNOSCHITZKI, 1954: 26-27 (sub *Anthicus c.* Marseul, det. Roubal); halobiont; Eastern Austria, Southern Europe (incl. Balkan Peninsula).

Cyclodinus constrictus (Curtis) - UHMANN, 1985: 185 (sub *C. c. var. lameyi* Marseul); UHMANN, 1989: 384 (sub *C. c. var. lameyi* Marseul); halobiont; France, Spain, Majorca, Sardinia, Balkan Peninsula, Crete, Turkey, North Africa.

Cyclodinus fatuus (Truqui) - UHMANN, 1989: 384; new data: Zlatni Pyasatsi, 1-21.VIII.1970, leg. Palm, in coll. Museum Lund (one beetle examined genitaliter by the first author); VIII; ecological remarks: unknown; Balkan Peninsula, South Russia, Cyprus, Syria, Israel, Jordan, Iran, Turkmenistan, Afghanistan.

Cyclodinus humilis (Germar) - NEDELKOV, 1909: 7 (sub *Anthicus h.* Germ.); KARNOSCHITZKI, 1950: 52-53 (sub *Anthicus h.* Germ.); IV-VI; halobiont; Central, Eastern and Southeastern Europe, Caucasus.

Cyclodinus minutus (Laferte) - KARNOSCHITZKI, 1950: 52 (sub *Anthicus m.* Laf.); IX; halobiont; Mediterranean.

Omonadus bifasciatus (Rossi) - UHMANN, 1989: 385; new data: Tsarevo, Hieke & Uhlig (1 ex.); phytodetriticol and stercoricol; Europe, Turkey, Georgia, Iran, Afghanistan, North Africa.

Omonadus floralis (Linne) - IOAKIMOV, 1904: 42; ANONYMOUS, 1907: 321 (sub *Anthicus f.* L.); NEDELKOV, 1907: 7 (sub *Anthicus f.* L.); UHMANN, 1985: 188; UHMANN, 1989: 385; new data: Kozhuh, Hieke (4 ex.); 10 km W Zemen, Hieke (1 ex.); IV; VII-X; phytodetriticol; Cosmopolit.

Omonadus formicarius (Goeze) (= *Anthicus quisquilius* Thoms.) - ANONYMOUS, 1907: 321 (sub *A. quisquilius* Thoms.); UHMANN, 1985: 188; new data: Samokov, Rila Mt., Uhlig (1 ex.); phytodetriticol and stercoricol; Cosmopolit.

Cordicomus instabilis (Schmidt) - PALM, 1966: 21; ripicol, phytodetriticol; Southern Europe, Northern Africa.

Cordicomus sellatus (Panzer) - PANIN, 1941: 552 ((sub *Anthicus (Eonius) sellatus* Panz.)); UHMANN, 1989: 385; new data: Kozhuh, Hieke (4 ex.); ripicol, psammophil, phytodetriticol; Europe.

Stricticomus longicollis (Schmidt) - new data: the coast near river Dvojnitza by Obzor, Braasch (1 ex.); likely phytodetriticol; southern parts of Central Europe, South Europe, Russia, Israel, Iraq. **New species for Bulgaria.**

Stricticomus transversalis (Villa) - KARNOSCHITZKI, 1954: 26 (sub *Anthicus t.* Villa); new data: Kozhuh, Hieke (1 ex.); V-VIII; stenotop; Spain, France, Czech Rep., Eastern Mediterranean.

Hirticomus hispidus (Rossi) - IOAKIMOV, 1904: 42; MARKOVICH, 1909: 20; NEDELKOV, 1909: 7 (sub *Anthicus h.* Rossi); PALM, 1966: 21; UHMANN, 1985: 192; UHMANN, 1989: 386; new data: the coast by Arkutino, Braasch (1 ex.); the coast by Kamchiya, Schulke (1 ex.); Tsarevo, Hieke & Uhlig (5 ex.); 2 km S Tsarevo, Uhlig (1 ex.); Melnik, Wendt (1 ex.); Kozhuh, Hieke (5 ex.); river Ropotamo, 5 km W Yasna Polyana, Hieke & Uhlig (2 ex.); Kazanlak, Hieke & Uhlig (4 ex.); IV-V; psammophil, phytodetriticol; Europe, Caucasus, West and Central Asia, Egypt.

Anthicus antherinus (Linne) - IOAKIMOV, 1904: 42; NEDELKOV, 1909: 7; ROUBAL, 1932: 129 (sub *A. a.* var. *sophiae*); PALM, 1966: 21; UHMANN, 1985: 193; UHMANN, 1985: 193 (sub *A. a.* var. *syriae* Pic); UHMANN, 1989: 386; new data: the coast by Arkutino, Braasch (4 ex.); chalet Raj, Central Stara Planina Mts., Uhlig (1 ex.); 2 km S Tsarevo, Uhlig (54 ex.); Kozhuh, Hieke (16 ex.); 10 km W Zemen, Hieke, (1 ex.); camp Aheloh, Göllner (1 ex.); IV-VI; psammophil, phytodetriticol; Europe, Turkey, Israel, Iran, Turkmenistan, Uzbekistan.

Anthicus ater (Panzer) - MARKOVICH, 1909: 20; X; psammophil, ripicol, phytodetriticol; Northern Europe, Russia, Bulgaria.

Anthicus axillaris Schmidt - UHMANN, 1985: 194; new data: Kozhuh, Hieke (1 ex.); 10 km W Zemen, Hieke (1 ex.); Kazanlak, Hieke & Uhlig (1 ex.); psammophil, ripicol, phytodetriticol; Europe.

Anthicus fenestratus Schmidt - UHMANN, 1989: 387; new data: camp Kavatsite, Göllner (1 ex.); xerophil; Mediterranean.

Anthicus flavipes (Panzer) - PANIN, 1941: 552; new data: Kozhuh, Hieke (11 ex.); psammophil, ripicol; Northern and Central Europe, France, Bulgaria, Turkey.

Anthicus fuscicornis Laferte - IOAKIMOV, 1904: 42; VIII-IX; ripicol; Spain, France, Italy, Bulgaria, Turkey.

Anthicus luteicornis Schmidt - PIC, 1911: 59; ripicol, psammophil; Southern Germany, France, Italy, Bulgaria.

Anthicus niger Olivier - UHMANN, 1989: 387; new data: Melnik, Wendt (2 ex.); the coast by Sveti Vlas, Schülke (1 ex.); Kozhuh, Hieke (30 ex.); Tsarevo, Hieke & Uhlig (1 ex.); xerophil; Mediterranean, Caucasus.

Anthicus proximus Marseul - RAMBOUSEK, 1912: 57; UHMANN, 1989: 387; ecological remarks: unknown; South Italy, Balkan Peninsula, Crete, Turkey, Israel, Oman.

Anthicus schmidtii Rosenhauer - new data: Kozhuh, Hieke (15 ex.); psammophil, ripicol, phytodetriticol; France, Switzerland, Austria, Poland, Hungary, Slovakia, Spain, Italy, Croatia, Bulgaria. **New species for Bulgaria.**

Anthicus tristis Schmidt - UHMANN, 1989: 387; new data: Kozhuh, Hieke (1 ex.), det as *A. t.* var. *tristiculus* Reitter; xerophil; Canary Islands, Mediterranean, Iraq, Iran, Turkmenistan, Afghanistan.

Microhoria oertzeni (Pic) - UHMANN, 1985: 201; ecological remarks: unknown; Balkan Peninsula, Turkey.

Microhoria raveli (Pic) - ROUBAL, 1932: 129 (sub *Anthicus nectarinus* Panzer var. *reveli* sic!); thermophil, phytodetriticol, as *M. nectarina* (Panzer); Italy, Balkan Peninsula, Crete, Rhodes, Turkey. **Note:** Describing *Anthicus raveli*, Pic confused some species. It described this taxon as a variety of *M. terminata* Schmidt but *M. terminata* and *M. nectarina* are coloured species, while *M. raveli* is black. KOCH (1933) found the right status of *raveli* Pic by examination of the male genitalia.

Endomia tenuicollis (Rossi) - UHMANN, 1985: 203; UHMANN, 1989: 387; new data: the coast by Arkutino, Braasch (1 ex.); Ropotamo, 5 km W Yasna Polyana, Hieke & Uhlig (1 ex.); thermophil, ripicol; Mediterranean to Southern Africa.

Another species has probably been recorded in Bulgaria by mistake:

Cyclodinus desbrochersi (Pic) - ROUBAL, 1932: 129 (sub *Anthicus debrochersi* sic!). Despite of the material of Roubal does not study, and judging from the distribution of the species, we consider it does not exist in Bulgaria. It occurs in Spain and North Africa. Unless new evidence becomes available, it is better to be excluded from the list of Bulgarian fauna for the time being.

Conclusion

It is for the first time that a detailed bibliographical, nomenclatural and chorological description of the family Anthicidae in Bulgaria has been made. Thirty-seven species from the nearly 320 species known in the European fauna until now have been established in this country (listed above in systematic order). Genus *Pseudotomoderus* Pic and the species *Pseudotomoderus compressicollis* Motschulsky, *Stricticomus longicollis* (Schmidt) and *Anthicus schmidtii* Rosenhauer have been found as new for the Bulgarian fauna. New faunistic data have been presented for 21 other species. It can be stated that *Cyclodinus desbrochersi* (Pic), published by ROUBAL (1932), does not exist in Bulgaria. For the majority of species some ecological categories (on the basis of their landscape preferences) have also been marked. For 12 species phenological data have been summarized.

Acknowledgements

We owe our best thanks to all colleagues who committed their material for study, and are especially indebted to Dr F. Hieke (Berlin, Germany) who was so kind as to preserved and sent the list of the Bulgarian anthicid beetles to his Bulgarian colleagues.

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Author's address:

Gerhard Uhmann
Tannenhofstrasse 10
D - 92690 Pressath (Bavaria)
Germany

Borislav Guéorguiev
National Museum of Natural History
1, Tsar Osvoboditel Blvd
1000 Sofia, Bulgaria
e-mail: bobivg@yahoo.com

Преглед на семейство Anthicidae (Coleoptera) от България

Герхард УМАН; Борислав ГЕОРГИЕВ

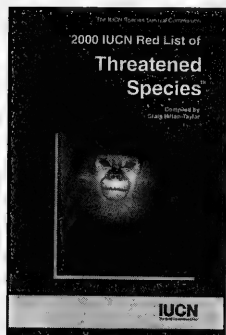
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Настоящата работа се основава на бележки, намерени в архива на починалия български колеоптеролог Васил Георгиев. В резултат на обработката им за първи път е направен литературно-номенклатурен и ареалографски преглед на Anthicidae от България. Под *Pseudotomoderus* Pic и видове *Pseudotomoderus compressicollis* Motschulsky, *Stricticomus longicollis* (Schmidt) и *Anthicus schmidtii* Rosenhauer са нови за българската фауна. За други 21 вида антициди (от всичко 37, установени у нас) са представени нови фаунистични данни. Видът *Cyclodinus desbrochersi* (Pic), съобщен от ROUBAL (1932), най-вероятно не се среща в страната. За повечето от представителите са отбелязани и екологичните категории на базата на предпочитанията им към типа на ландшафта, а за 12 вида са обобщени данните за сезонната им активност.

Нова Световна червена книга

Алекси ПОПОВ

HILTON-TAYLOR C. (Compiler). 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK. XVIII + 61 p. + CD-ROM.



Българските зоолози, ботаници и природолюбители очакваха с нетърпение и интерес новото издание на Международния съюз за опазване на природата (IUCN) за застрашените видове организми. Неговите предшественици добиха популярност у нас като Световна червена книга, но по същество представляват Световен червен списък. Използваните сега категории на IUCN са: изчезнал (EX), изчезнал в природата (EW), критично застрашен (CR), застрашен (EN), уязвим (VU), зависим от опазването (cd), почти застрашен (nt), слабо застрашен (lc), с недостатъчно данни (DD). Като застрашени се обединяват CR, EN и VU, а в група с нисък риск (LR) се включват cd, nt и lc.

Основната разлика между най-новото и предишните издания на книгата е комбинацията от печатна версия (книжно тяло) и електронна версия (компакт диск) и обединяването на животните и растенията в едно издание. Книгата съдържа сумарен анализ по групи,

страни, биом, хабитати и преглед на заплахите, а компакт дискът - конкретната информация за видовете. Читателят може да търси данни по страни, по категории на застрашеност и по райони (континенти и океани и големи части от тях).

Общият брой на включените в Червената книга таксони е 18 276. От тях 816 вида са изчезнали (EX, EW), 11 046 са застрашени с изчезване (CR, EN, VU), 4595 са с нисък риск (cd, nt, lc) или недостатъчно данни (DD) и 1769 са подвидове или субпопулации. Общо животните са 10 487, а растенията - 7789. Относителният дял на застрашените видове (CR, EN, VU) спрямо всички видове е най-голям при бозайниците (24 %), голосеменните растения (16 %) и птиците (12 %). На видово ниво най-многобройни са бозайниците (2133 вида), птиците (2123), охлювите (1822) и костните риби (1159 вида) от животните и двусеменните (6293 вида) от растенията.

При подреждането по страни за основните групи животни и растения по-предни места заемат тропически, извъневропейски и островни държави и територии. От балканските страни в челните двадесетници влизат Хърватия и Гърция за риби и Словения (на пето място), Румъния и Югославия за безгръбначни. Ако разгледаме броят на застрашените видове (CR, EN, VU) в отделните страни на Балканския полуостров, получаваме следната картина: Словения - 85 вида, Румъния и Гърция - по 59 вида, Югославия - 49, България - 46, Хърватия - 44 и гр. (Турция с Мала Азия - 81). Общо във всички категории (от EX до DD) за България в компакт диска са посочени 128 вида (в таблицата по страни) и 143 вида (в таблицата на видовете). Този брой е занижен, тъй като в списъка за България са посочени видове, които не се срещат у нас, напр. *Troglocaris anophthalmus* (пещерна скарида), а за други, които се срещат, България не е посочена в ареала. Най-висока степен на застрашеност (CR) имат *Acipenser sturio* (немска есетра), дунавската популация на *Cyprinus carpio* (шаран), *Numenius tenuirostris* (среден свирец) и *Monachus monachus* (тюлен монах). Следващата степен (EN) имат 9 вида: отново риби, птица и бозайник, както и *Vipera ursinii* (остромучунеста усойница). Уязвими са 38 вида, между които пакообразни (Amphipoda, Decapoda) и насекоми (Odonata, Orthoptera, Coleoptera, Lepidoptera). Единственото растение от България е балканският ендемит *Pinus peuce* (бяла мур) в категорията LR/nt.

Новото издание на Световната червена книга ще бъде твърде полезен справочник при засилените в последно време изследвания с консервационна насоченост, при подготовката на нова Червена книга на България и при работата на зоолозите от НПМ с музейни колекции от чуждестранни животни.

Macrolepidoptera and Microlepidoptera (Alucitidae and Pyralidae) recorded in Bulgaria, 12 - 24 September 1995 (Lepidoptera)

Stoyan BESHKOV, Barry GOATER

Introduction

During the period September 12-24, 1995 the authors visited several places in SW Bulgaria, East Rhodopi Mts and Black Sea Coast where the lepidopterous fauna was explored. On September 12, a few moths were collected at a 125 W Hg lamp on the balcony of the home of the first of the authors in Sofia, Mladost IV. H.E. In all the other localities given below, moths were collected using a 160 W Hg lamp plugged in, or powered by a Honda EX 350 generator, and by means of a red wine and sugar 1:1 mixture painted on tree trunks. Several species were also found aestivating in tunnels, one in Kresna Gorge and another in Melnik Town, and a few were recorded by day. Nearly all Pyralidae were determined by B. Goater with only a few additions made by S. Beshkov. Alucitidae were identified by S. Beshkov. The only species of Psychidae was determined by P. Hattenschwiler (Uster, Switzerland). All Macrolepidoptera were identified by both authors together, mostly in the field, except for the specimens determined later by examination of genitalia. The identity of all the doubtful species was checked in this way. Only a minimal number specimens were retained, but lists were made of all species seen. The collected material is in the collections of the two authors. Below are included all the data gathered during the expedition. Only a few species of butterflies are listed because public transport (trains and buses) was used for getting about and most of the daylight hours were spent traveling or waiting for transport in a town.

List of the main collecting localities

Kresna - SW Bulgaria, Kresna Gorge, Stara Kresna Railway Station, 200 m alt., 13.IX.1995.

Melnik - SW Bulgaria, Melnik Town, Sandanski District, 400 m alt., 14.IX.1995.
Rozhen - SW Bulgaria, Rozhen Village above Melnik Town, 580 m alt., 15.IX.1995.

Studen Kladenetz - East Rhodopi Mts, Studen Kladenetz Village, Arda Valley, 180 m alt., 18.IX.1995.

Momina Skala - East Rhodopi Mts, Arda Valley, Momina Skala Chalet near Madzharovo Town, 140 m alt., 19.IX.1995.

Meden Buk - East Rhodopi Mts, Zhaltichalsko Dere near Byala Reka River by Meden Buk Village, Ivailovgrad District, 150 m alt., 20.IX.1995.

Byalo Pole (= Belopolyane Village) - East Rhodopi Mts, Ivailovgrad District, 180 m alt., 21.IX.1995.

Arkutino - South Black Sea Coast, "Arkutino" Resting House near Arkutino Swamp and the Mouth of Ropotamo River, Primorsko District, 22.IX.1995.

Balchik (= Balcic) - North Black Sea Coast, Belia Bryag Camping between Balchik and Kavarna towns, 2 km NE from "Tuzlata", 23.IX.1995.

Leucania punctosa (Treitschke, 1828) is new for the Bulgarian fauna. In the list are included 262 species.

In Belia Bryag Camping many species, most of them in considerable numbers, were observed under a *Prunus divariacata* Ldb. tree, feeding on the secretions of the aphid *Pterochloroides persicae* (Chol., 1899), from the family *Lachnidae* (E. Tasheva det.), dropped from the tree. Moths were much more numerous beneath that tree than on the trees which had been anointed with wine-sugar mixture. The species recorded on aphid secretion were: *Udea ferrugalis*, *Nomophila noctuella*, *Camptogramma bilineata*, *Lygephila cracca*, *Hoplodrina ambigua*, *Thalpophila matura*, *Phlogophora meticulosa*, *Atethmia ambusta*, *Discestra trifolii*, *Leucania putrescens*, *Mythimna albipuncta*, *Mythimna vitellina*, *Mythimna l-album*, *Acantholeucania loreyi*, *Noctua pronuba*, *Xestia xanthographa*, *Peridroma saucia*, *Agrotis puta*, *Agrotis ipsilon*, *Agrotis segetum*.

Abbreviations used in the list:

L - specimen/s collected at light

S - specimen/s collected at red wine and sugar 1:1 mixture

D - collected or observed by day

R - collected at rest on lamps in or around buildings

s - single specimen

r - rare species, 2-3 specimens recorded

c - common species, 4-10 specimens recorded

a - abundant, more than 10 specimens recorded

Table 1

List of the species

Names of the taxa	Kresna Melnik Rozhen Studen Momina Meden Byalo Arkutino Balchik Note									
	1	2	3	4	5	6	7	8	9	10
HEPIALIDAE										
<i>Triodia amasius dobrogensis</i> (Caradja, 1932) = <i>Korscheltellus amasius ponticus</i> Car. sensu Popescu-Gorj, 1964				L,a	L,r	L,s			L,c	1
<i>Triodia silvina</i> (Linnaeus, 1761)	L,s	L,r	L,s	L,r	L,s	L,s				2
PSYCHIDAE										
<i>Eochorica balcanica</i> (Rebel, 1919)		L,a								3
ALUCITIDAE										
<i>Alucita grammodactyla</i> Zeller, 1841	L,s									4
<i>Alucita cymmatodactyla</i> Zeller, 1852									L,s	5
PYRALIDAE										
<i>Euchromius ocellea</i> (Haworth, 1811)								L,s		6
<i>Agriphila tristella</i> ([Denis & Schiffermüller], 1775)			R,s							7
<i>Agripigila inquinatella</i> ([Denis & Schiffermüller], 1775)				L,s		L,s			R,s	8
<i>Agriphila brionella</i> (Zerny, 1914)	D,r,L,s	L,r								9
<i>Agriphila latistria</i> (Haworth, [1811])								L,s		10
<i>Agriphila dalmatinella</i> (Hampson, 1900)	D,L,r	L,r		L,c		L,r			L,s	11
<i>Pediasia matricella</i> (Treitschke, 1832)	L,c			L,r	L,r	L,s	L,r			
<i>Catoptiria confusella</i> (Staudinger, 1882)										
<i>Ancyloloma palpella</i> ([Denis & Schiffermüller], 1775)	L,s	L,r								
<i>Ancylolomia tentaculella</i> (Hübner, 1796)			L,s			L,r				
<i>Eudonia mercurella</i> (Linnaeus, 1758)				L,s						
<i>Evergestis limbata</i> (Linnaeus, 1767)										
<i>Evergestis serratalisi</i> (Staudinger)				L,s	L,c	L,c	L,r	L,s		

	1	2	3	4	5	6	7	8	9	10
<i>Aporodes floralis</i> (Hübner, [1809])		L,s								
<i>Hellula undalis</i> (Fabricius, 1781)						L,s	L,s			
<i>Purausta aurata</i> (Scopoli, 1763)							L,s			
<i>Pyrausta purpurals</i> (Linnaeus, 1758)		L,s								
<i>Pyrausta sanguinalis</i> (Linnaeus, 1767)		L,s				L,s				
<i>Pyrausta rectefascialis</i> (Toll, 1936)										
<i>Ecpyrrhoroe rubiginalis</i> (Hübner, 1796)		L,s		L,s			L,c			
<i>Paracorsia repandalis</i>							L,s			
([Denis & Schiffermüller], 1775)										
<i>Ostrinia nubilalis</i> (Hübner, 1796)	L,r	L,s		L,s						
<i>Eucasta splendida</i> (Herrich-Schäffer)	L,s						L,s			
<i>Ebulea testacealis</i> (Zeller, 1847)	D,s									
<i>Udea ferrugalis</i> (Hübner, 1796)	L,r	L,r			L,r	L,r	L,r	L,s	L,s;S,r	12
<i>Nomophila noctuella</i>										
([Denis & Schiffermüller], 1775)										
<i>Antigastra catalaunalis</i> (Duponchel, 1833)	L,s			L,r	L,s	L,s	L,s	L,s	L,s;S,s	13
<i>Metasia ophialis</i> (Treitschke, 1829)	L,r					L,r	L,c			
<i>Pleuroptiya ruralis</i> (Scopoli, 1763)	L,r	L,r				L,s	L,r			
<i>Palpita unionalis</i> (Hübner, 1796)			L,s	L,s	L,s	L,s	L,s			
<i>Palpita incoloralis</i> (Guenée, 1854)					L,s					
<i>Hypopygia costalis</i> (Fabricius, 1775)							L,s			
<i>Actenia brunnealis</i> (Treitschke, 1829)	D,r	L,r								
<i>Actenia honestalis</i> (Treitschke, 1829)										
<i>Orthopygia fulvicalialis</i> (Duponchel, 1834)	L,r							L,s		
<i>Pyralis regalis</i>										
([Denis & Schiffermüller], 1775)										
<i>Pyralis farinalis</i> (Linnaeus, 1758)	L,s	R,r							R,r	14
<i>Eudotrica flammealis</i>										
([Denis & Schiffermüller], 1775)										
<i>Oenocera semirubella</i> (Scopoli, 1763)	L,r	L,s				L,s				
<i>Bradynrhoea gilveolella</i> (Treitschke)	L,s									
<i>Etiella zinckenella</i> (Treitschke, 1832)				L,s		L,r	L,s			15
		L,r				L,r			L,s	

	1	2	3	4	5	6	7	8	9	10
<i>Oxybia transversella</i> (Duponchel, 1836)		L,r					L,s			
<i>Conobathra repandana</i> (Fabricius, 1798)					L,s					
<i>Trachycera advenella</i> (Zincken, 1818)		L,s								
<i>Spermatophthora hornigii</i> (Lederer, 1852)									R,r; L,s	
<i>Phytoides albatella</i> (Ragonot, 1887)										
<i>Cadra furcatella</i> (Herrich-Schäffer, 1849)		L,r						L,s		16
PAPILIONIDAE										
<i>Iphitelides podalirius</i> (Linnaeus, 1758)										17
<i>Papilio machaon</i> Linnaeus, 1758										18
PIERIDAE										
<i>Pieris rapae</i> (Linnaeus, 1758)						D,c				
<i>Pontia edusa</i> (Fabricius, 1777)		D,c	D,a			D,c				
<i>Colias crocea</i> (Geoffroy, 1785)		D,c			D,c	D,c				
NYMPHALIDAE										
<i>Nymphalis polychloros</i> (Linnaeus, 1758)		a								19
<i>Inachis io</i> (Linnaeus, 1758)										20
<i>Pandoriana pandora</i>										
([Denis & Schiffermüller], 1775)		D,a	D,c		D,c					21
<i>Issoria lathonia</i> (Linnaeus, 1758)		D,c				D,c				
<i>Hipparchia syriaca</i> (Staudinger, 1871)		D,r	D,c	D,r	D,r	D,r				
<i>Hipparchia senthes</i> (Fruhstorfer, 1908)			D,c							
<i>Hipparchia fatua</i> (Freyer, 1845)				D,r		D,r				
LYCAENIDAE										
<i>Lycaena phlaeas</i> (Linnaeus, 1761)		D,c	D,c	D,c						
<i>Polyommatus icarus</i> (Rottemburg, 1775)				D,r						
DREPANIDAE										
<i>Drepana binaria</i> (Hufnagel, 1767)					L,s	L,s				22
<i>Gilix glaucata</i> (Scopoli, 1763)	L,s	L,s		L,c		L,s		L,s		
THYATIRIDAE										
<i>Thyatira batis</i> (Linnaeus, 1758)										
<i>Cymatophorima diluta</i>										
([Denis & Schiffermüller], 1775)										

	1	2	3	4	5	6	7	8	9	10
GEOMETRIDAE										
Hemihelinae										
<i>Hemistola chrysoprasaria</i> (Esper, 1794)		L,s								
<i>Euchrostes indigignata</i> (de Villers, 1789)	L,r		L,s	L,s						
Sterrhinae										
<i>Cyclophora puppillaria</i> (Hübner, [1799])		L,s		L,s	L,s		L,s			
<i>Timandra griseata</i> W. Petersen, 1902							L,s			
<i>Scopula ochraceata</i> Staudinger, 1901	L,s	L,s		L,r	L,c	L,r	L,r			
<i>Scopula marginepunctata</i> (Goeze, 1781)		L,r		L,r		L,r	L,s	L,r	L,s	
<i>Scopula imitaria</i> (Hübner, [1799])	L,s	L,s		L,s					R,s	
<i>Glossotrophia confinaria</i> (Herrich-Schäffer, 1847)		L,s		L,s						23
<i>Idaea filicata</i> (Hübner, [1799])	L,s	L,s								
<i>Idaea dimidiata</i> (Hufnagel, 1767)							L,s			
<i>Idaea camparia</i> (Herrich-Schäffer, [1852])		L,s			L,s					
<i>Idaea aversata</i> (Linnaeus, 1758)								L,s	L,r	24
<i>Idaea degeneraria</i> (Hübner, [1799])		L,s			L,r		L,r			
<i>Rhodometra sacraria</i> (Linnaeus, 1767)	L,r			L,s	L,s	L,s				
Larentiinae										
<i>Lythria purpuraria</i> (Linnaeus, 1758)	D,s									
<i>Cataclysmes rigata</i> (Hübner, [1813])		L,s								
<i>Xanthorhoe fluctuata</i> (Linnaeus, 1758)					L,s		L,s			
<i>Epirrhone galiata</i> ([Denis & Schiffermüller], 1775)									L,s	
<i>Costaconvexa polygrammata</i> (Borkhausen, 1794)										
<i>Campptogramma bilineata</i> (Linnaeus, 1758)		L,s					L,s			
<i>Catarhoe permixtaria</i> (Herrich-Schäffer, 1851)	L,r	L,s							R,s,S,s	
<i>Cosmorhoe ocellata</i> (Linnaeus, 1758)										
<i>Nebula ablutaria</i> (Boisduval, 1840)							L,s		L,s	
<i>Colostygia</i> sp.										25
<i>Horysme corticata</i> (Treitschke, 1835)	L,r	L,r							L,r	26

	1	2	3	4	5	6	7	8	9	10
<i>Perizoma bifasciata</i> (Haworth, 1809)	L,s									
<i>Eupithecia linariata</i> ([Denis & Schiffermüller], 1775)								L,s		
<i>Eupithecia variostriata</i> Alpheraky, 1878									R,r	
<i>Eupithecia centaureata</i> ([Denis & Schiffermüller], 1775)				L,s			L,s			27
<i>Eupithecia innotata</i> (Hufnagel, 1767)								L,s		28
<i>Eupithecia ochridata</i> Pinker, 1968	L,r						L,s			29
<i>Eupithecia orphnata</i> W. Petersen, 1909					L,s					
<i>Eupithecia ericeata</i> Rambur, 1833										
<i>Gymnoscelus rufifasciata</i> (Haworth, 1809)				L,s		L,s				
<i>Minva murinata</i> (Scopoli, 1763)	D,r									
<i>Aplocera plagiata</i> (Linnaeus, 1758)									L,s	30
<i>Aplocera dervenaria</i> von Mentzer, 1981	L,s	L,s								
Boarmiinae										
<i>Ligdia adustata</i> ([Denis & Schiffermüller], 1775) L,s			L,s							
<i>Semiolitha alternaria</i> (Hübner, [1809])										
<i>Tephрина arnacearia</i> ([Denis & Schiffermüller], 1775)										31
<i>Artiora evonymaria</i> ([Denis & Schiffermüller], 1775)							L,r			
<i>Ennomos erosaria</i> ([Denis & Schiffermüller], 1775)	L,s									
<i>Ennomos fuscantaria</i> (Haworth, 1809)						L,s				
<i>Eumera regina</i> Staudinger, 1892						L,s	L,c			
<i>Crocallis tusciaria</i> (Borkhausen, 1793)										
<i>Crocallis elingvaria</i> (Linnaeus, 1758)	L,r			L,s	L,r	L,s	L,r			32
<i>Nychiodes dalmatina</i> (Wagner, 1909)	L,r									33
<i>Nychiodes waltheri</i> (Wagner, 1919)							L,c			
<i>Peribatodes rhomboidaria</i> ([Denis & Schiffermüller], 1775)	L,r	L,s	L,s;S,s	L,r	L,r	L,r	L,r	L,s;S,s	L,s;S,s	34
<i>Peribatodes umbraria</i> (Hübner, [1809])	L,r	L,r		L,s	L,r	L,r	L,r			

	1	2	3	4	5	6	7	8	9	10
<i>Peribatodes correptarius</i> (Zeller, 1847)	L,r			L,r	L,c	L,r	L,r			35
<i>Selidosema plumarium</i> (Denis & Schiffermüller], 1775)	L,r	L,s	L,s *	L,s		L,r	L,s		L,r	
<i>Gnophos sartatus</i> Treitschke, 1827	L,r			L,s	L,s			L,s		
<i>Campaea margaritata</i> (Linnaeus, 1767)	L,r			L,s		L,s	L,r	L,r		
<i>Aspilates ochrearia</i> (Rossi, 1794)	D,c;L,r			L,r		L,s	L,r	L,r	R,r;L,r	36
<i>Dyscia sicaniaria</i> Zeller, 1852				L,r	L,r		L,r		R,r;L,s	
LASIOCAMPIDAE										
<i>Lasiocampa trifolii</i> (Denis & Schiffermüller], 1775)	L,r	L,r	L,r	L,r	L,c	L,c	L,c		L,s	37
LEMONIIDAE										
<i>Lemonia balcanica</i> (Herrich-Schäffer, 1843)					L,r	L,r	L,r		L,s	
SPHINGIDAE										
<i>Agrius convolvuli</i> (Linnaeus, 1758)										38
<i>Hyles euphorbiae</i> (Linnaeus, 1758)				L,s			L,s			
<i>Macroglossum stellatarum</i> (Linnaeus, 1758)		D,r		D,c			L,s		L,s	
NOTODONTIDAE										
<i>Pterostoma palpinum</i> (Clerck, 1759)							L,s			
<i>Clostera pygma</i> (Hufnagel, 1766)										
THAUMETOPOEIDAE										
<i>Thaumetopoea pityocampa</i> (Denis & Schiffermüller], 1775)		L,s								
<i>Thaumetopoea solitaria</i> (Freyer, 1838)		L,s		L,s		L,r	L,a			
LYMANTRIIDAE										
<i>Lymantria dispar</i> (Linnaeus, 1758)	L,s									
<i>Sphragideus similis</i> (Fuessly, 1775)					L,s					
ARCTIIDAE										
<i>Eilema sororecula</i> (Hufnagel, 1766)								L,s		
<i>Eilema morosina</i> (Herrich-Schäffer, 1848)	L,r	L,r								39
<i>Eilema caniola</i> (Hübner, [1808])	L,s	L,r		L,r	L,c	L,r	L,c	L,r	L,r	40
<i>Eilema pseudocomplana</i> (Daniel, 1939)	L,c					L,r	L,r			
<i>Phragmatobia fuliginosa</i> (Linnaeus, 1758)			L,s							
<i>Euplagia quadripunctaria</i> (Poda, 1761)	L,s		L,r	L,s	L,s		L,s			

	1	2	3	4	5	6	7	8	9	10
CTENUCHIDAE										
<i>Dysauxes famula ponitica</i> Friese, 1959	L, c	L, c	L, c	L, c	L, c	L, c	L, r		L, s	
NOCTUIDAE										
Hermiiniinae										
<i>Orectis proboscidata</i> (Herrich-Schäffer, [1851])					L, r					
<i>Polypogon plumigeralis</i> (Hübner, [1825])						S, s				
Rivulinae										
<i>Parascotia fuliginaria</i> (Linnaeus, 1761)	L, s		S, s; L, s			L, s				
Hypenodinae										
<i>Schrankia costaestrigalis</i> (Stephens, 1834)							L, s	L, r		
Hypeninae										41
<i>Hypena rostralis</i> (Linnaeus, 1758)		L, s; c								
Catocalinae										
<i>Catocala nupta</i> (Linnaeus, 1767)	L, s					S, s				
<i>Catocala elocata</i> (Esper, [1787])		S, s	S, s	S, s			L, s; S, s			
<i>Catocala puerpera</i> (Giorna, 1791)	S, s									
<i>Grammodes bifasciata</i> (Petagna, 1787)								L, r		
<i>Prodotis stolidi</i> (Fabricius, 1775)				L, s			S, s			
<i>Lygephila cracca</i>										
([Denis & Schiffermüller], 1775)									S, s	
<i>Apopestes spectrum</i> (Esper, [1787])		S, s								
<i>Autophila ligaminosa</i> (Eversmann, 1851)		r								42
<i>Tyta luctuosa</i>										
([Denis & Schiffermüller], 1775)		L, s								
Nolinae										
<i>Meganola strigula</i>										
([Denis & Schiffermüller], 1775)	L, s									
Sarrothripinae										
<i>Nycteola siculana</i> (Fuchs, 1899)		L, s							L, s	
<i>Nycteola asiatica</i> (Krulikovskiy, 1904)				L, s						
Chloephorinae										
<i>Bena bicolorana</i> (Fuessly, 1775)				L, s	L, s					43

[illegible]

	1	2	3	4	5	6	7	8	9	10
Ipimorphinae										
<i>Praestitilia armeniaca</i> Staudinger, 1892	L,c;S,r				L,r		L,c	L,s		51
<i>Platyperigea kadenii</i> (Freyer, 1836)		L,s								
<i>Paradrina flavirena</i> (Guenée, 1852)	L,s	L,r		L,s	L,s					
<i>Paradrina clavipalpis</i> (Scopoli, 1763)										52
<i>Hoplodrina ambigua</i>										
(Denis & Schiffermüller], 1775)	L,r	L,r	L,s	L,c	L,c	L,r	L,c	L,r	L,s;S,s	53
<i>Spodoptera exigua</i> (Hübner, [1808])	L,s	L,s		L,s	L,s	L,r				
<i>Sesamia nonagrioides</i> (Lefebvre, 1827)	L,s									54
<i>Dupterygia scabriuscula</i> (Linnaeus, 1758)	S,s									
<i>Anthraxia eriopoda</i>										
(Herrich-Schäffer, [1851])										55
<i>Mormo maura</i> (Linnaeus, 1758)	L,s	S,s		S,r		S,r				
<i>Polyphaenis subsericata</i>										
(Herrich-Schäffer, [1861])	L,c;S,r			L,s	L,r					
<i>Thalophila matura</i> (Hufnagel, 1766)	L,r			L,c;S,r	L,r	L,s	L,c;S,r	L,r	R,r;L,s;S,s	
<i>Phlogophora meticulosa</i> (Linnaeus, 1758)		L,s					L,s		S,s	
<i>Mesogona acetosellae</i>										
([Denis & Schiffermüller], 1775)							L,s			
<i>Atethmia centrago</i> (Haworth, 1809)				L,r			L,s	L,r	L,r	
<i>Atethmia ambusta</i>										
([Denis & Schiffermüller], 1775)	L,r									56
<i>Agrochola ostheldei</i> Boursin, 1951					L,s			L,s	S,s;L,s	57
<i>Agrochola graticiosa</i> (Staudinger, 1882)		L,s;S,s	S,r							
<i>Episema glaucina</i> (Esper, 1789)					L,s					
<i>Episema tersa</i>										
([Denis & Schiffermüller], 1775)		L,s		L,s		L,r	L,r			
<i>Episema lederi</i> Christoph, 1885				L,r			L,c			
= <i>sareptana</i> Alpheraky, 1897										
<i>Episema korsakovi</i> (Christoph, 1885)				L,c	L,r	L,r	L,r			
<i>Aporophila canescens</i> (Duponchel, 1826)				L,r			L,s			
<i>Meganephria bimaculosa</i> (Linnaeus, 1767)							L,s			

	1	2	3	4	5	6	7	8	9	10
<i>Dryobotodes monochroma</i> (Esper, [1790])					L,s					
<i>Dryobotodes carbonis</i> (F. Wagner, 1931)							L,s			
<i>Polymixis serpentina</i> (Treitschke, 1825)					L,r	L,r				
<i>Mesapamea secalis</i> (Linnaeus, 1758)				L,s			L,s			58
<i>Luperina rubella rubella</i> (Duponchel, 1835)	L,r							L,r		
<i>Luperina rubella sericea</i> (Caradja, 1932)									L,r	59
<i>Luperina dumerilii</i> (Duponchel, 1826)				L,c	L,r	L,s		L,c		
<i>Gortyna flavago</i> ([Denis & Schiffermüller], 1775)										
Hadeninae										
<i>Discestra trifolii</i> (Hufnagel, 1766)		L,r		L,s		L,s	L,r	L,s	S,s	
<i>Lacanobia oleracea</i> (Linnaeus, 1758)			S,s				L,s			60
<i>Leucania herrichi</i> Herrich-Schäffer, 1849				L,r						
<i>Leucania putrescens</i> (Hübner, [1824])	L,s;S,r	L,s	L,s;S,r						S,r	61
<i>Leucania punctosa</i> (Treitschke, 1828)							S,s			
<i>Mythimna ferrago</i> (Fabricius, 1787)							L,r			
<i>Mythimna albipuncta</i>										
([Denis & Schiffermüller], 1775)	L,r			L,r;S,s	L,r		L,r	L,s	L,s;S,s	
<i>Mythimna vitellina</i> (Hübner, [1808])				L,r;S,s	L,s	L,s	L,r	L,s	R,s;L,s;S,s	
<i>Mythimna congrua</i> (Hübner, [1817])									L,s	
<i>Mythimna l-album</i> (Linnaeus, 1767)				L,s					R,s;L,s;S,s	
<i>Mythimna sirpi</i> (Duponchel, 1836)	L,s	L,r								
<i>Acantholeucania loreyi</i> (Duponchel, 1827)										
<i>Tholera decimalis</i> (Poda, 1761)					L,s	L,s			L,s;S,s	
Noctulinae										
<i>Ochroleura flammatra</i>										
([Denis & Schiffermüller], 1775)	L,s									
<i>Noctua pronuba</i> Linnaeus, 1758	S,s;L,r			S,s	L,s	L,r	L,r		S,s	
<i>Latanoctua orbona</i> (Hufnagel, 1766)									S,s	
<i>Paranoctua commes</i> (Hübner, [1813])	L,r		L,s	L,s	L,s;S,s	L,s;S,s	L,s			
<i>Paranoctua interposita</i> (Hübner, [1870])									L,s	62
<i>Lampra fimbriata</i> (Schreber, 1759)				L,s	L,r					63

	1	2	3	4	5	6	7	8	9	10
<i>Lampra tirrenica</i> (Biebinger, Speidel & Hanigk, 1983)	L,s	L,s								64
<i>Euschesis tertia</i> (von Mentzer, Moberg & Fibiger, 1991)			S,s							65
<i>Internoctua interjecta</i> (Hübner, [1803])							L,s	L,r		
<i>Divaeana haywardi</i> (Tams, 1926)	L,s;S,s									
<i>Epilecta linogrisea</i> ([Denis & Schiffermüller], 1775)				L,s	L,r					
<i>Chersotis rectangula</i> ([Denis & Schiffermüller], 1775)		L,s			L,r					66
<i>Eugnorisma pontica</i> (Staudinger, 1892)		L,r;S,c	S,a						L,s	
<i>Xestia c-nigrum</i> (Linnaeus, 1758)	L,s									
<i>Xestia xanthographa</i> ([Denis & Schiffermüller], 1775)										
<i>Xestia cohaesa</i> (Herrich-Schäffer, [1849])	L,s;S,r	S,c;L,c	S,s;L,s	L,s	L,r		L,s;S,s	L,c	L,s;S,s	67
<i>Peridroma saucia</i> (Hübner, [1808])		L,c			L,a	L,c	L,c		S,r	68
<i>Euxoa cos</i> (Hübner, 1824)						L,s			L,s	
<i>Euxoa distinguenda distincta</i> Staudinger, 1892									L,r	
<i>Euxoa temera</i> (Hübner, [1808])		L,s;S,s							L,s	
<i>Euxoa segnilis</i> (Duponchel, 1836)										
<i>Euxoa obelisca</i> ([Denis & Schiffermüller], 1775)			L,s		L,s			L,s		
<i>Agrotis obesa scita</i> Alpheraky, 1889 = <i>A. obesa nivea</i> Caradja, 1932 (L.T.: Balciç)									L,r	
<i>Agrotis crassa</i> (Hübner, [1803])	S,r;L,r	L,r;S,r	L,s;S,s	L,r		L,s				
<i>Agrotis puta</i> (Hübner, [1803])	L,r;S,r		L,s				L,r		L,r;S,s	
<i>Agrotis ipsilon</i> (Hufnagel, 1766)	L,s					S,s			L,s;S,s	
<i>Agrotis trux</i> (Hübner, [1824])	L,c;S,r	L,r;S,r		L,s;S,s	L,s		L,s			
<i>Agrotis segetum</i> ([Denis & Schiffermüller], 1775)	S,r	S,s					S,s		S,s	
<i>Agrotis vestigialis</i> (Hufnagel, 1766)								L,a		
<i>Agrotis exclamatoris</i> (Linnaeus, 1758)										69

Notes

1. L.T.: - Balcic (= Balchik), 08. and 20. November, 1931 and Carmen Silva (Romania) - CARADJA (1932: 41) - *Hepialus dobrogensis* ssp. (?) nov. and p. 45: *Hepialus amasinus* ssp. *dobrogensis*. In some articles GANEV (1984: 416) and some others the year of the description of the species is wrongly given as 1934 (Dt. Ent. Z. Iris, Bd. 48: 185-191). Genitalia of many specimens from Balchik and East Rhodopi Mts checked.

2. In POPESCU-GORJ (1964) in the text (p. 19) this species is given as *Korscheltellus amasinus dobrogensis* Car., but in the illustration (Fig. 1.) as *Korscheltellus amasinus ponticus* Car. We consider *Korscheltellus amasinus ponticus* sensu POPESCU-GORJ (1964) as a syn. n., nomen nudum of *Triodia amasinus dobrogensis* (Caradja, 1932).

3. The genitalia of all *Triodia* specimens in bad condition were checked.

4. More than 20 ♂ specimens at light, det. P. Hattenschwiler (Uster, CH).

5. One ♂, genitalia checked.

6. Genitalia checked.

7. Genitalia checked.

8. Rozhenski Manastir, 15.IX.1995, one inside building.

9. Genitalia checked.

10. Genitalia checked.

11. Genitalia checked from all localities.

12. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

13. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

14. Several specimens observed on a ceiling in a market in Melnik Town.

15. Genitalia of all specimens checked.

16. Genitalia checked.

17. East Rhodopi Mts, Haskovo Town, 18.IX.1995, single specimen.

18. Single specimen observed near Novo Delchevo Village in SW Bulgaria, Melnik District, 14.IX.1995.

19. Wings of specimens eaten by bats in the tunnel under Stara Kresna Railway Station; 11 specimens observed aestivating in the tunnel in the museum "Kordopulovata Kashta" House in Melnik Town, 15.IX.1995.

20. Wings of specimens eaten by bats in the tunnel under Stara Kresna Railway Station.

21. Central Bulgaria, Stara Zagora Town, 22.IX.1995, several specimens observed.

22. Genitalia checked.

23. Genitalia checked.

24. Genitalia checked by both authors.

25. One ♂ and one ♀ (undetermined), Gen. preps 21-22./30.I.1996, Beshkov.

26. Rozhenski Manastir, 15.IX.1995, three specimens inside building.

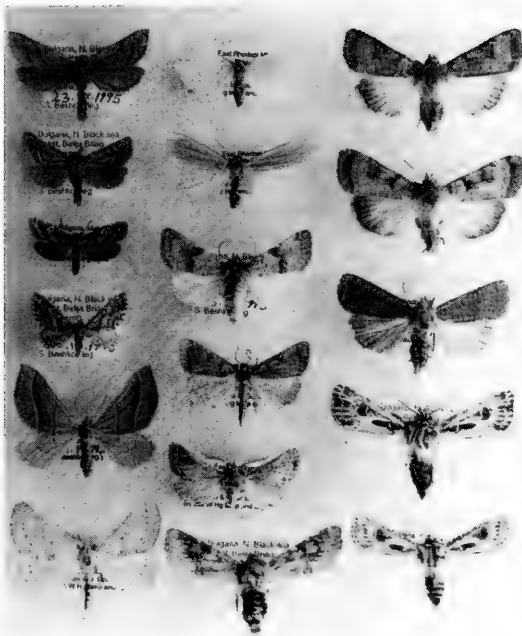


Fig. 1 - 17.

First column: 1. *Triodia amasinus dobrogensis*, ♀ - Balchik, 23.IX.1995. 2. *Triodia amasinus dobrogensis*, ♂ - Balchik, 23.IX.1995. 3. *Eochorica balcanica*, ♂ - Melnik, 14.IX.1995. 4. *Eupithecia variostrigata*, ♀ - Balchik, 23.IX.1995. 5. *Aplocera dervenaria*, ♀ - Melnik, 14.IX.1995. 6. *Dyscia sicanaria*, ♂ - Byalo Pole, 21.IX.1995.

Second column: 7. *Eilema pseudocomplana*, ♀ - Byalo Pole, 21.IX.1995. 8. *Eilema caniola*, ♂ - Byalo Pole, 21.IX.1995. 9. *Mycteroplus puniceago*, ♂ - Balchik, 23.IX.1995. 10. *Praestilbia armeniaca*, ♂ - Byalo Pole, 21.IX.1995. 11. *Episema lederi*, ♂ - Byalo Pole, 21.IX.1995. 12. *Luperina rubella sericea*, ♀ - Balchik, 23.IX.1995.

Third column: 13. *Eugnorisma pontica*, ♂ - Melnik, 14.IX.1995. 14. *Eugnorisma pontica*, ♂ - Melnik, 14.IX.1995. 15.

Xestia cohaesa, ♀ - Momina Skala Chalet near Madzharovo, 19.IX.1995. 16. *Agrotis obesa scythia*, ♂ - Balchik, 23.IX.1995. 17. *Agrotis vestigialis*, ♂ - Arkutino, 22.IX.1995.

27. One ♀, genitalia checked.

28. Collected also in Sofia Town, "Mladost IV" H.E., 12.IX.1995. Genitalia of all specimens checked.

29. One ♂ specimen, genitalia checked.

30. Genitalia checked.

31. SW Bulgaria, Gradeshnitsa Village, Kresna District, 14.IX.1995, one on window of inn.

32. Genitalia not checked.

33. Genitalia not checked.

34. East Rhodopi Mts, Borislavtsi Village, 20.IX.1995, single specimen resting on a wall.

35. SW Bulgaria, Gradeshnitsa Village, Kresna District, 14.IX.1995, one on window of inn.

36. Ivailovgrad Dam, 20.IX.1995, three specimens resting on a wall by police checkpoint.

37. East Rhodopi Mts, Borislavtsi Village, 20.IX.1995, single specimen resting on a wall.

38. East Rhodopi Mts, Madzharovo Town, 19.IX.1995, one resting on a post.

39. Genitalia of many specimens checked.

40. Genitalia of many specimens checked.

41. Approximately 10 specimens aestivating in the tunnel under Stara Kresna Railway Station; four specimens observed aestivating in the tunnel in the museum "Kordopulovata Kashta" House in Melnik Town, 14.IX.1995.

42. Three specimens collected aestivating in the tunnel in the museum "Kordopulovata Kashta" House in Melnik Town, 14.IX.1995.

43. For the nomenclature see MIKKOLA & HONEY (1993).

44. For the nomenclature see MIKKOLA & HONEY (1993).

45. Both specimens worn.

46. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

47. One ♂ specimen, Genitalia checked.

48. For the nomenclature see MIKKOLA & HONEY (1993).

49. Genitalia checked.

50. 29 specimens collected at rest inside buildings to which they had been attracted by previous nights' illumination. The day before the collecting the temperature had decreased by about 15°C.

51. Rozhenski Manastir, 15.IX.1995, several males inside building.

52. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

53. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

54. Rozhenski Manastir, 15.IX.1995, one inside building.

55. One worn specimen at sugar.

56. East Rhodopi Mts, Borislavtsi Village, 20.IX.1995, single specimen resting on a wall.

57. In Bulgaria known from Kresna Gorge (GANEV & HACKER, 1984; BESHKOV, 1992), East Rhodopi Mts: Studen Kladenetz Village and Momina Skala Chalet near Madzharovo Town (BESHKOV, 1995).

58. Genitalia of all *Mesapamea* specimens checked.

59. L.T.: - Balçic (Balchik), 06.November, 30. December 1930 CARADJA (1932) - *Palluperina (Luperina) rubella* ssp. nov. *sericea*.

60. Two ♀ specimens in a bad condition were collected. Till now known in Bulgaria only from East Rhodopi Mts, Momina Skala Chalet near Madzharovo (BESHKOV, 1995).

61. Single male specimen (Fig. 18) at sugar, a new species for the Bulgarian fauna.

62. One worn specimen, genitalia checked.



Fig. 18. *Leucania punctosa*, ♂ - Byalo Pole, 21.IX.1995.

63. Genitalia checked.

64. Genitalia checked.

65. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

66. All specimens worn.

67. Genitalia of many specimens checked.

68. Genitalia checked.

69. Sofia Town, "Mladost IV" H.E., 12.IX.1995.

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Addresses of the authors:

Stoyan Beshkov
National Museum of Natural History
1, Tsar Osvoboditel Blvd
1000 Sofia, Bulgaria

Barry Goater
"The Ridge", 27 Hiltingbury Road
Chandlers's Ford, Eastleigh,
Hants, SO53 5SR, England

Macrolepidoptera u Microlepidoptera (Alucitidae u Pyralidae), установени в България в периода 12 - 24 септември 1995 (Lepidoptera)

Стоян БЕШКОВ, Бари ГОТЪР

(Р е з ю м е)

Представени са резултатите от колекционната експедиция на авторите през споменатия период в Югозападна България, Източните Родопи, Черноморското крайбрежие и някои други части на страната. Във всичките споменати в работата находища нощните пеперуги са ловени на светлинна ловилка и на хранителна примамка от червено вино и захар. За всеки от съобщените видове е указан начинът и времето на улавянето му и приблизителният период на наблюдаваните екземпляри. В списъка са включени всичките 262 вида, установени през периода. *Leucania punctosa* (Treitschke, 1828) е нов вид за пеперудната фауна в България. Голяма част от видовете са нови за изследваните райони, друга част са с ограничен брой находища в страната. Приложени са снимки на новия и на останалите по-интересни видове и някои допълнителни пояснения.

On the distribution, biology and ecology of amphibians and reptiles in the Derventski Heights and the Sakar Mountain, South-East Bulgaria

Pavel STOEV

Introduction

Although much information on the distribution of the Bulgarian herpetofauna has been accumulated since the end of the nineteenth and the beginning of the twentieth century there are still some poorly explored regions. This is also true for the regions of the Sakar Mountain and the Derventski Heights, both of which have long been overlooked by the Bulgarian and foreign herpetologists. Only recently, CHLEBICKI (1985) provided some new information on the distribution and status of some reptiles and amphibians in Sakar.

The present paper is devoted to the herpetological investigations carried out in the Derventski Heights and the Sakar Mountain in the period of 1989 - 1992. The explored territory belongs to Bourgas and Haskovo districts. The following settlements and their vicinities were visited: the **Sakar Mountain**: Radovetz Village (UTM: MG 54), Ustrem Village (UTM: MG 55), Mramor Village (UTM: MG 55); the **Derventski Heights**: Lesovo Village (UTM: MG 64), Lesovo Mine (UTM: MG 64), Melnitza Village (UTM: MG 65), Voden Village (UTM: MG 95), Kraynovo Village (UTM: MG 85), Malko Sharkovo Village (UTM: MG 86) and Golyam Dervent Village (UTM: MG 74) (Fig. 1).

Material and methods

The main part of the scientific investigations were carried out by the author, the rest are contributions by Georgi Seizov, tutor of Biology in Jambol and chief of the local Ornithological Club, Borislav Borisov, zoologist at the Regional Inspectorate of the Ministry of Environment and Waters in Haskovo, and Boyan Petrov, from the National Museum of Natural History in Sofia. Eight expeditions

were organized mainly during the months of April, May and September. The main part of the studies were carried out during the day and only sporadically during the night. Most of the amphibians and reptiles were caught or found dead and then preserved in ethanol and some were only observed. A few of the caught specimens are kept now in the collections of the National Museum of Natural History - Sofia.

Landscape, climate and vegetation

The region is situated between the Strandzha Mountain and the Eastern Rhodopes Mountain and comprises hilly and lowland types of landscape. To the south the Derventski Heights and the Sakar Mountain reach down the Bulgarian - Turkish frontier. Most of the territory consists of agricultural and urban land. The highest hill of the Derventski Heights is Gyurgen Bair Peak (555 m a.s.l.). The highest point of the Sakar Mountain is Vishegrad Peak (856 m a.s.l.). The climate is Submediterranean, characterized by warm and mild winters, and hot and dry summers. The maximum of the precipitation occurs in December, January and February. The vegetation is predominantly of xerotherm type such as the broad-leaved mixed *Quercetum-Fraxinus* association. It is the commonest forest type in

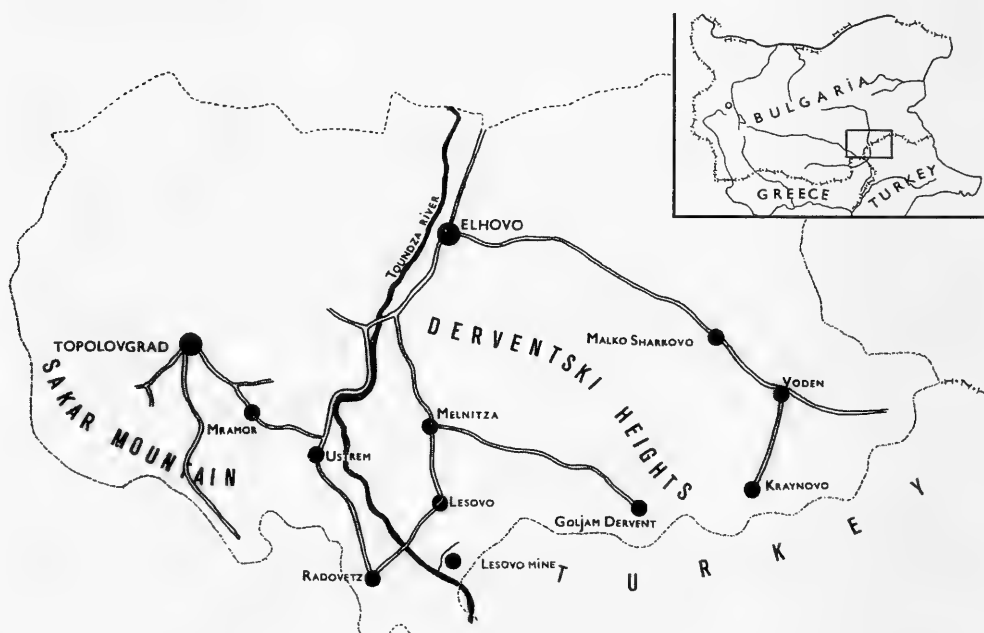


Fig. 1. Map of the investigated regions

the region. The only mesophytic forests are located along the Tundza River and in a short stripe along the frontier. The open landscapes are covered mainly by *Paliurus spina-cristi* shrubs and various herbs.

List of species

A m p h i b i a

Triturus superspecies cristatus (Laurenti, 1768)

Localities. *Elhovo District*: one specimen, Kraynovo, a nameless pot hole, 23.05.1991, P. Stoev leg.; one specimen, Lesovo, beneath a stone, 14.05.1990, P. Stoev leg.

Remarks. The crested newt is a comparatively rare species in the studied regions. This is chiefly due to the general lack of marches, pools, puddles and other habitats, suitable for its survival and to the comparatively low humidity of the investigated regions.

Triturus vulgaris (Linnaeus, 1758)

Localities. *Elhovo District*: two females and one male, Lesovo, in a small river flowing into the Toundzha River, 03.04.1991, P. Stoev leg.; several specimens, same locality, in a small puddle, P. Stoev observ.; one specimen, same locality, in an artificial mine gallery, April, 1992, P. Stoev leg.; two specimens, Voden, Samardaala Pot hole, 11.10.1992, G. Seizov leg.

Remarks. In the catalogue of BESHKOV and BERON (1964) *T. vulgaris* is mentioned as widely spread in the country, with the exception of the Strandzha and Sakar Mountains. Latter on, CHLEBICKI (1985) reported the smooth newt for Sakar. On the basis of our observations in the Derventski Heights, although it has not been discovered yet, it is quite possible to presume that its range includes the Strandzha Mountain as well. Only very intensive collection work can settle the problem.

Pelobates syriacus balcanicus (Karaman, 1928)

Localities. *Elhovo District*: one specimen, Lesovo, near the Toundzha River in a rainy night, 5.09.1990, P. Stoev leg.

Remarks. Recorded only once, a wider distribution of this interesting animal can be expected. Scarcity is solely due to its specific behavior and night activity.

Bufo bufo spinosus (Daudin, 1803)

Localities. *Elhovo District*: two copulating specimens, Lesovo, in the Toundzha River, 1.04.1989, P. Stoev observ.; one specimen, same locality, 14.05.1990, P. Stoev leg.; numerous specimens, same locality, 1-6.04.1991, P.

Stoev. observ.; one specimen, Lesovo, a mine gallery, 09.04.1992, P. Stoev leg.; two females, one adult male and three juveniles, Melnitza, Dranchi Douпка Pot hole, 7.04.1991, P. Stoev, G. Seizov & B. Borisov leg.; one specimen, Melnitza, Karaburnu Pot hole, 3.04.1992, P. Stoev leg.; two specimens, Kraynovo, a nameless pot hole, 23.05.1991, P. Stoev leg.; one specimen, Kraynovo, Dalbokata Douпка Cave, 12.09.1992, P. Stoev, G. Seizov & B. Borisov leg.

Remarks. Despite the great number of observed specimens the subspecific status of this toad has not been examined yet, but because of its huge length and fairly big and oval parotid glands it can be expected to belong to *spinusus*, a subspecies which has already been recorded for Bulgaria and seems to have replaced the nominate one in the southern and lowland regions.

***Bufo viridis* (Laurenti, 1768)**

Localities. *Topolovgrad District:* one specimen, Ustrem, Tjasnata Propast Pot hole, 30.03. 1992, P. Stoev leg.; one specimen, Mramor, Mladezhkata Pot hole, 31.03.1992, P. Stoev & G. Seizov leg.

Remarks. It's a fairly common toad in the investigated regions. It is often found in human settlements and in pot holes where it has fallen accidentally.

***Hyla arborea* (Linnaeus, 1758)**

Remarks. It is one of the commonest frogs in the investigated regions. *Hyla arborea* was often found around the water containers of the village of Lesovo and the Toundzha River, particularly during the spring months.

***Rana ridibunda* Pallas, 1771**

Remarks. It is the most common amphibian species, spread in almost every water container in the explored regions. It was discovered in the Toundza River, around the Lesovo Mine and the villages of Lesovo, Melnitza and Goljam Dervent.

***Rana dalmatina* Bonaparte, 1840**

Localities. *Elhovo District:* one specimen, Lesovo, 3.04.1989, P. Stoev leg.; one specimen, Melnitza, Dranchi Douпка Pot hole, 7.04.1991, P. Stoev, G. Seizov & B. Borisov observ.; two specimens, same locality, Karaburnu Pot hole, 3.04.1992, P. Stoev leg.; two specimens, Kraynovo, a nameless pot hole, 23.05.1991, P. Stoev leg.

Remarks. It is a fairly common species in the investigated territory.

R e p t i l i a

***Testudo hermanni* Gmelin, 1789**

Localities. This turtle was recorded several times from the surroundings of Lesovo and Radovetz. In 1990 fourteen specimens were captured in those places

and one specimen was recorded from the Bulgarian-Turkish frontier, between Lesovo and Goljam Dervent.

Remarks. It is a fairly common species in the investigated regions.

***Testudo graeca ibera* Pallas, 1814**

Localities. *Testudo graeca ibera* is a common species in the investigated regions, and is regularly met in different seasons and years in the surroundings of Lesovo, Goljam Dervent and Radovetz.

Remarks. No special statistics has been done to clarify which is the predominant turtle in the Sakar and the Derventski Heights but I tend to believe that both species are represented in almost equal proportions.

***Emys orbicularis* (Linnaeus, 1758)**

Localities. *Elhovo District:* the Toundzha River; a small river flowing into the Toundzha River, 4-12.09.1990, P. Stoev leg.; one specimen, between Goljam Dervent and Lesovo, 28.04.1991, P. Stoev & G. Seizov leg.

Remarks. Although sporadically discovered, undoubtedly *Emys orbicularis* is quite wide spread in the investigated regions.

***Mauremys caspica rivulata* (Valenciennes, 1833)**

Localities. *Elhovo District:* numerous specimens of both sexes, Lesovo, a small river flowing into the Toundzha River (UTM: MG: 64), P. Stoev observ. & leg.

Remarks. This species has already been reported for the Sakar Mountain by CHLEBICKI (1985). The present find is extending its range eastwards thus connecting the records from Eastern Rhodopes with those from the Black Sea coast. The small river flowing into the Toundza River is inhabited by both *Emys orbicularis* and *Mauremys caspica rivulata*, the latter being nearly six times more abundant. It can probably be found in the Toundzha River as well.

***Cyrtodactylus kotschy danilewskii* (Strauch, 1887)**

Localities. *Elhovo District:* one specimen, Lesovo, 1.04.1991, P. Stoev leg.; one specimen, Lesovo Mine, 2.04.1991, P. Stoev observ.; one specimen, Melnitsa, 18.09.1992, P. Stoev & B. Petrov observ.

Remarks. It has already been discovered in the town of Elhovo. The present localities only extend its range some 30 km. southwards. Since one of the localities is situated some 3-4 km from the Bulgarian-Turkish frontier it may also be present in the settlements on the Turkish side. Its local name is "dazhdovnik" or "dazhdovniche".

***Pseudopus apodus thracicus* (Obst, 1978)**

Localities. *Elhovo District:* several adults and two juvenile specimens, Lesovo, 1-10.04.1989, P. Stoev leg. & observ.; three specimens, same locality, 14-

15.05.1990, P. Stoev leg.; seven specimens, same locality, 1-06.04.1991, P. Stoev leg.; numerous specimens, same locality, 1-12.04. 1992, P. Stoev leg. & observ.; two specimens, Goljam Derwent, 10.05.1991, P. Stoev observ.; one specimen, Melnitza, Karaburnu Pot hole, 3.04.1992, P. Stoev leg.; **Topolovgrad District:** one specimen, Radovetz, 21.09.1992, P. Stoev leg.; one specimen, Ustrem, "Sveta Troitza" Monastery, 27.04.1991, P. Stoev & G. Seizov leg.; one juvenile specimen, Mramor, Mladezhka Pot hole, 31.03.1992, P. Stoev & G. Seizov leg.

Remarks. It is a fairly common animal for the whole investigated territory, although in some urban and agricultural lands is quite reduced in number. It was found to be feeding on snails and once on a small rodent, resembling very much the migratory hamster *Cricetulus migratorius*. Its local name is "kyoralan" and "slepok".

***Ablepharus kitaibelii* Bibron & Bory, 1833**

Localities. **Elhovo District:** one specimen, Kraynovo, a nameless pot hole, 23.05.1991, P. Stoev leg.

Remarks. Although *Ablepharus kitaibelii stepaneki* Fuhn, 1970 is the only subspecies recorded from the whole territory of Bulgaria, I can not be certain whether my specimen really belongs to it, because of lack of accurate determination. In the explored regions *Ablephaurus kitaibeli* was found only once but one might expect it to be more widely spread.

***Lacerta trilineata* Bedriaga, 1886**

Localities. It was discovered practically everywhere in the regions, most frequently occurring in dry meadows covered with *Paliurus spina-cristi* shrubs. My finds come from the surroundings of Lesovo Mine and the villages of Lesovo, Melnitza, Radovetz and Goljam Derwent.

Remarks. A fairly common species in the studied regions. Its subspecific status is yet to be examined.

***Lacerta viridis* (Laurenti, 1768)**

Localities. **Topolovgrad District:** one specimen, Mramor, Dranchi Douпка Pot hole, 29.03.1992, P. Stoev leg.

Remarks. Although it has been reported from Sakar by CHLEBICKI (1985) I cannot be certain whether I have really come across this species during my trips in the investigated regions. If the species occurs there, it seems less numerous than its sibling species *Lacerta trilineata*. The only record that I attribute to *viridis* is that of the Dranchi Douпка Pot hole. Much more profound work is necessary in order to establish its present distribution in the Sakar Mountain and the Derventska Heights.

***Podarcis taurica* (Pallas, 1814)**

Localities. A fairly common species in the studied regions, regularly found in the surroundings of the villages of Radovetz, Lesovo and Melnitza.

Remarks. Together with *Lacerta trilineata* it is one of the most frequently observed lizard in the Derventski Heights and the Sakar Mountain. Its is mostly found in dry meadows covered with bushes of *Paliurus spina-cristi* and isolated trees.

***Eryx jaculus* (Linnaeus, 1758)**

Localities. Elhovo District: one specimen, Lesovo Mine, 06.09.1988, B. Borisov leg.; one specimen, same locality, April, 1990, G. Seizov leg.; one juvenile specimen, Length - 22 sm., same locality, 17-17:30 h, 15.05.1990, P. Stoev leg.; one juvenile specimen, Length - 12,2 sm., same locality, 16.05.1990, P. Stoev leg.; one adult specimen, Length - 46 sm., same locality, 8.09.1992, P. Stoev leg.

Remarks. In the period of 1988-1992 five specimens were encountered in the explored regions. All of them come from the surroundings of the Lesovo Mine, which is the only locality of *jaculus* known up to now from the Derventski Heights. It may occur in similar habitats in the Sakar Mountain as well.

***Typhlops vermicularis* Merrem, 1820**

Localities. Elhovo District: one specimen, Lesovo, beneath a stone, 18.05.1990, P. Stoev leg.

Remarks. It is the only record of *T. vermicularis* in the region of the Strandzha Mountain - Derventski Heights. The nearest records are from the valley of Maritza, situated approximately 40 km westward from our find. *T. vermicularis* is obviously a rare species in the explored regions, but a more systematic research will certainly result in extension of its range in South-east Bulgaria.

***Coluber caspius* Gmelin, 1789**

Localities. Elhovo District: three adult specimens, one of which is 166 cm long, Lesovo Mine, 1-10.04.1989, P. Stoev leg. & observ.; two specimens, same locality, 14-15.05.1990, P. Stoev observ.; one juvenile specimen, Lesovo, 19.09.1992, P. Stoev leg.; one specimen, between Lesovo and Goljam Dervent, 28.04.1991, P. Stoev leg.; **Topolovgrad District:** one specimen, Radovetz, 21.09.1992, B. Petrov leg.

Remarks. It is a fairly common snake in the investigated regions.

***Coluber najadum dahlia* Schinz, 1833**

Localities. Elhovo District: one juvenile specimen, Lesovo Mine, April, 1990, B. Borisov & G. Seizov leg.; one adult specimen, same locality, 15.05.1990, P. Stoev observ.

Remarks. *C. najadum* is a Mediterranean species whose northern border of distribution passes through the country. It is fairly common in the Struma Valley, south of the town of Dupnitsa, and in the Eastern Rhodopes, and it is rarely recorded from the central and western regions of the Rhodopes. This record from

the Derventski Heights traces out the easternmost border of its distribution in Bulgaria. The old records of *najadum* from the Black sea coast are probably due to its misidentification as some other species *Coluber rubriceps* (Venzmer, 1919) is known to occur there (Vl. Beschkov, personal information).

***Elaphe longissima* (Laurenti, 1768)**

Localities. *Elhovo District*: two juvenile specimens, Lesovo Mine, 1-10.04.1989, P. Stoev leg.; one specimen, same locality, 18.05.1990, P. Stoev leg.; one specimen, same locality, 1-12.04.1992, P. Stoev leg.

Remarks. *E. longissima* does not seem to be a rare species in the Derventski Heights and the Sakar Mountain. Since it is primarily connected with the mesophylous broad-leaved forests, a more profound research of these habitats will undoubtedly prove its wider distribution in the investigated regions.

***Elaphe quatuorlineata sauromates* Pallas, 1814**

Localities. *Elhovo District*: one specimen, Length - 140 cm, between Lesovo and Goljam Dervent, 28.04.1991, P. Stoev leg.

Remarks. Both subspecies of *E. quatuorlineata*, the nominal and *sauromates*, are known from Bulgaria. Although widely spread in the country in the beginning of the twentieth century, due to the expansion of farming, and particularly the transformation of desolate area into agricultural lands, this very beautiful snake has become seriously threatened by extinction. The National Museum of Natural History in Sofia keeps numerous specimens collected from Dobroudja, Thracia and other regions of Bulgaria, where this snake is now either completely exterminated or nearly extinct. The regions of the Strandzha and Sakar Mountains and the Derventski Heights are probably the last sanctuaries of *E. quatuorlineata sauromates* in Bulgaria, as the Struma Valley is for the nominal subspecies.

***Malpolon monspessulanus insignitus* (Geoffroy, 1827)**

Localities. *Elhovo District*: one specimen, between Kraynovo and Goljam Dervent near Gyurgen Bair Peak, 500 m a.s.l., 10.05.1991, P. Stoev leg.

Remarks. Only one specimen of this snake has been caught, but undoubtedly it is much more numerous, since it has also been discovered in the Strandzha Mountain and the Eastern Rhodopes.

***Natrix tessellata* (Laurenti, 1768)**

Localities. *Elhovo District*: one specimen, Melnitza, Starata Cave, 3.04.1992, P. Stoev & G. Seizov observ.; several times in different seasons and years, Lesovo Mine, near the Toundzha River, P. Stoev observ.

Remarks. A fairly common species in the investigated regions.

***Natrix natrix natrix* (Linnaeus, 1758)**

Localities. *Elhovo District*: one specimen, Lesovo Mine, 6.04.1991, P. Stoev leg.

***Natrix natrix persa* (Pallas, 1814)**

Localities. *Elhovo District*: six specimens, Lesovo Mine, 14.05.1990, P. Stoev leg.; one specimen, same locality, 1.04.1992, P. Stoev leg.

Remarks. Both subspecies of *Natrix natrix* are known from the studied regions, but it seems that *persa* is the predominant one. A more profound research will settle the question.

***Vipera ammodytes meridionalis* Boulenger, 1903**

Localities. *Elhovo District*: one specimen, Lesovo Mine, 1-10.04.1989, P. Stoev leg.; two specimens, same locality, 14-16.05.1990, P. Stoev leg. & observ.; one juvenile and one adult specimens, same locality, 19-21.09.1992, P. Stoev leg. & observ.; three juvenile specimens and one adult, Malko Sharkovo, 09.05.1991, P. Stoev observ.; two juvenile specimens, Melnitza, Karaburnu Pot hole, 3.04.1992, P. Stoev leg.; one specimen, between Lesovo and Goljam Dervent, 9.09.1992, P. Stoev observ.; one specimen, Voden, 11.09.1992, P. Stoev observ.; *Topolovgrad District*: one specimen, Radovetz, 1-10.04.1989, P. Stoev observ.; one specimen, same locality, 12.04.1992, P. Stoev observ.

Remarks. Since 1990 *Vipera ammodytes* has been gradually destroyed by uncontrolled catching for the purposes of private farms, producing venom. Its populations in the explored regions have been seriously endangered by the local hunters of snakes but fortunately this "venomous" mania ended with only few enterprises left. Now, the populations of *V. ammodytes* in the regions of the Sakar Mountain and the Derventski Heights are probably slightly increasing.

Conclusions

The current research on the amphibians and reptiles in the Sakar Mountain and the Derventski Heights has considerably enriched our knowledge of the distribution of the herpetofauna in Bulgaria. Along with the Kresna Gorge, the Southern part of the Black Sea Coast and the Eastern Rhodopes Mountain, the region of the Toundzha River, the Derventski Heights and the Sakar Mountain is one of the richest regions in terms of herpetological diversity. Eight species of Amphibia and twenty one species and subspecies of Reptilia were found to occur there, which constitutes 55 % of the Bulgarian herpetofauna. Five other species (*Salamandra salamandra*, *Bombina variegata*, *Angius fragilis*, *Lacerta praticola* and *Coronella austriaca*) although not discovered during these trips are quite widely distributed in the country and will probably be discovered in the investigated territory in the future.

Acknowledgements

I am obligated to Mrs Fani Bozarova for the map preparation and to Dr Vladimir Beschkov for his valuable comments on the manuscript. My best thanks are also due to Georgi Seizov, Borislav Borisov and Boyan Petrov for their support in conducting this survey and for the provided information.

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Author's address:

Pavel Stoev

National Museum of Natural History

1, Tsar Osvoboditel Blvd

1000 Sofia, Bulgaria

E-mail: pavelsto@nettaxi.com

Върху разпространението, биологията и екологията на земноводните и влечугите на Дербентските възвишения и Сакар планина

Павел СТОЕВ

(Резюме)

Обобщават се наблюденията на автора върху разпространението и отчасти биологията и екологията на 29 вида и подвида земноводни и влечуги, установени в района на Дербентски възвишения и Сакар планина през периода 1989-1992 г. Тя се явява първото по рода си комплексно изследване на херпетофауната на посочените райони, показващи видово богатство, сравнимо само с това на Кресненското дефиле, Южното Черноморие и Източните Родопи. Интерес представлява установяването на най-източното находище на *Coluber najadum dahlia* в България, на първото находище на *Triturus vulgaris* в района на Странджа-Сакар, както и намирането на няколко редки видове - *Pelobates syriacus balcanicus*, *Mauremys caspica rivulata*, *Eryx jaculus*, *Typhlops vermicularis* и *Elaphe quatuorlineata sauromates*. Възможно е да бъдат намерени и нем дгуи вида - *Salamandra salamandra*, *Bombina variegata*, *Angius fragilis*, *Lacerta praticola* и *Coronella austriaca*, които не са установени до момента.

Експедиция на НПМ в Северна Гърция (15-29.09.2000)

Боян П. ПЕТРОВ

От гледна точка на родните зоолози Северна Гърция е "липсващото средиземноморско парче" от разнообразната мозайка на българската природа. Отделни райони в тази част на южната ни съседка са изследвани и от българи, но засега липсват обзори проучвания върху фауната по южните склонове на Родопите. Пещерната фауна на Източна Македония и Тракия е най-системно проучвана от Петър Берон, Стоице Андреев и Владимир Бешков.

Като продължение на изследователските дейности на нашите по-възрастни колеги организирах експедиция, която беше финансирана по проект на Изследователския фонд на Американското арахнологично дружество (American Arachnological Society Research Fund). Основната цел беше събирането на псевдосcorpioni от южните склонове на Родопите и прилежащите планини. С участието на колегите Павел Сточев и Стоян Бешков експедицията придоби по-завършен научен вид и се разшири обхватът на групите за събиране.

На 15.09.2000 г. се озовахме в Солун, където с колеги от Биологическия факултет на Университета обсъдихме нашия маршрут, както и планове за бъдещо сътрудничество. Същата вечер спяхме по южните склонове на Олимп, а на другата сутрин изкачихме най-високата точка на планината - вр. Митика (2917 м). Въпреки сухото лято успяхме да съберем интересен материал от алпийската зона. Следващата точка от пътуването ни беше пещерата Петралона, намираща се почти в центъра на Халкидическия полуостров. С любезното съдействие на директора на пещерния музей г-р Aris Roulianos се запознахме с праисторията на тези земи. На път за Серес посетихме известната благоустроена пещера при село Alistrati, откъдето събрахме интересен материал, съдържащ непубликувани досега видове. Следващата основна цел беше карстовият район на манастира Св. Иван над Серес, където посетихме пещерата Piladele и в задния двор на църквата в изоставеното българско село Лаохот открийме непогребани останки от българи. Следващата цел беше изкачването на най-високия връх на Боздаг - вр. Вардина (2232 м). Изкачването осъществихме на 21.09.2000, като вероятно сме първите български зоолози, които събират материал от алпийската зона на тази планина. Същата вечер спяхме в Доспат дере, близо до пещерата Peristerones, за чиято фауна не открийме никакви публикувани данни. От тази близо разположена до нашата граница пещера събрахме нов вид пещерна диплопода от род *Balkanopetalum*. Следващите посетени от нас пещери бяха 12 км водна пещера Маага при с. Агитис и Aghia Helleni и Mavri Ttira при с. Зигос близо до Кавала. По покана на колеги от организацията "Арктурос" посетихме тяхната изследователска база, разположена сред смърчовите гори на високите части на Западните Родопи, малко по-на юг от граничните ни села Кестен и Буйново. Оттам след 60 км по черен планински път минахме през гара Бук и се отправихме към с. Пашалий. В близост до селото посетихме пещерата Дупката, за която не намерихме никакви публикувани сведения. Тя се оказа второто находище на новия вид *Balkanopetalum*, както и първото досега известно за новия вид *Roncus* (Pseudoscorpiones: Neobisiidae). Оттам през Ксанти се отправихме към с. Марония, където посетихме 2,5 км пещера Cyclope polypheme. Маршрутът ни по-нататък продължи със събиране на материал през Дедеагач, Есими (Доган хисар), най-високата точка на гръцките Източни Родопи (вр. Шанка, 1065 м) и резервата Дагя. В долината на Бяла река близо до нашата граница посетихме прилепната пещера Koufovocho, която беше последният заплануван обект.

С бюджет от 460 \$ за 15 дни изминахме с лагата 2550 км, изкачихме два върха над 2000 м, събрахме материал от над 45 находища, 13 нощи лампите на Бешков привлечаха нощни насекоми, посетихме и събрахме материал от 10 пещери. Предварителният преглед на събраните животни показва наличието на поне 4 нови за науката видове от групите Pseudoscorpiones и Diploroda. Експедицията обогати музейния фонд с материал от близки, но сравнително рядко посещавани от българи територии.

Late Pleistocene Avifauna of the Razhishkata Cave, Western Bulgaria

Zlatozar BOEV

Introduction

Last few years a series of publications on the Late Pleistocene fauna of birds in Bulgaria has appeared. With an exception of the more exhaustive data on the Pleistocene birds of the Bacho Kiro Cave (BOCHENSKI, 1982), the papers on the Pleistocene avifauna of Bulgaria deal with avian remains from caves, mainly from the NW parts of the country (BOEV, 1995; 1998; 1999a; 1999b; 2000).

Description of the site

Location: Near to the Lakatnik railway station, Sofia District, UTM grid: KH 68; about 500 a. s. l. (Fig. 1).

Associated fauna: *Cuon alpinus*, *Capra ibex*, *Crocidura leucodon*, *Chionomys nivalis*, *Microtus subterraneus* (V. Popov, pers. comm.).

Dating: The final of the Late Pleistocene, probably including the transition to Holocene (V. Popov, pers. comm.).

Taphonomy: The avian remains were accumulated by the large nocturnal raptors, most probably, the Eagle Owl (*Bubo bubo*).

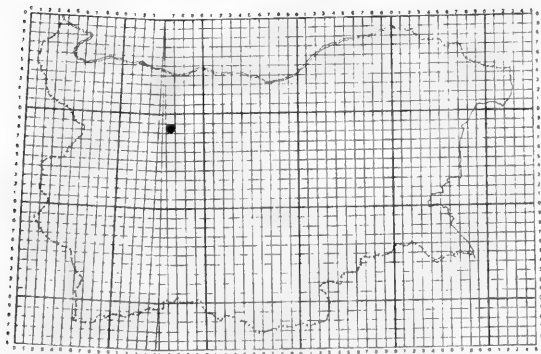


Fig. 1. Location of the Razhishkata Cave

Material and methods

A total of 185 whole bones and bone fragments of birds were collected: No 6471-6499; 7577-7603; 7930-7958; 8512-8526; 8918-8923; 9670-9694; 11275-11327; 11442. All finds are kept in the Fossil and Recent Birds Department of the National Museum of Natural History, Bulgarian Academy of Sciences, Sofia. The whole vertebrate's bone material was collected through the washing and sieving of the excavated sediments by Dr. Vassil Popov (Institute of Zoology, BAS), who handed the avian remains for examination.

The anatomical and stratigraphical belonging of the skeletal elements of each find is shown on Table 1. The osteological terminology follows BAUMEL & WITMER (1993). The reference measurements, given in mm, are provided only for the species established for the first time in the fossil record in Bulgaria (Table 2).

Species composition

The avifauna in the surroundings of the cave was rich and varied. At least 27 species (39 taxa) of 7 orders of birds are established by their bone remains (Table 1). They are referred both, to resident and migratory (breeding and winter visitors) species according to their present-day residential status of their populations on the Balkans.

Palaeoecological analysis

The established species composition shows the distribution of 4 ecological types of birds according to their nesting-habitat preferences (after Harrison, 1975): wood, field, water and rock. The species that indicate the former distribution of mixed, chiefly broad-leaved, forests are the most numerous. This group consists of 11 taxa: *Tetrao tetrix*, *Bonasa bonasia*, *Asio otus*, *Anthus* cf. *trivialis*, *Parus major*, *Sylvia* sp., *Fringilla montifringilla*, *Loxia curvirostra*, *Coccothraustes coccothraustes*, *Carduelis chloris* and cf. *Garrulus glandarius*. The species that needs of openland landscape to nest and feed are placed second. Their group consists of 6 taxa: *Perdix palaeoperdix*, *Perix perdix*, *Coturnix coturnix*, *Melanocorypha* sp., *Carduelinae* gen., and *Corvus corone/fragilegus*. The hydrophilous species indicating the presence of a large fresh-water slow running or steady bodies are referred to 4 taxa: *Anser* sp., *Anas* sp., *Crex crex* and *Tringa* cf. *stagnatilis*. The composition of the petrophilous bird species includes 7 taxa: *Athene noctua*, *Apus melba*, *Ptyonoprogne rupestris*, *Corvus monedula*, *Pyrhcorax graculus*, *Pyrhcorax pyrrhcorax* and *Petronia petronia*.

Table 1
Taxonomic list, collection numbers, sounding, depth (cm) and MNI (minimum number of individuals) of the Late Pleistocene birds of the Razhishkata Cave

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Num- ber of finds	MNI
ANSERIFORMES			
<i>Anser</i> sp.	phalanx dist. dig. pedis - 9688 (s. 2)	1	1
<i>Anas</i> sp.	scapula sin. dist. - 6492 (s. 2/100-120)	1	1
GALLIFORMES			
<i>Tetrao tetrix</i>	humerus sin. prox. - 6493 (s. 2/155); cranium - rostrum - 7582 (s. - /290-298)	2	1
<i>Tetrao</i> cf. <i>tetrix</i>	phalanx. dist. dig. pedis. - 6495 (s. 2/155-165)	1	1
<i>Bonasa bonasia</i>	coracoid dex. prox. - 7591 (s. - /420); vert. cerv. III - 7592 (s. -/ 420); phalanx 1dig. I pedis sin.- 7593 (s. - / 420)	4	1
<i>Bonasa</i> cf. <i>bonasia</i>	os quadratum sin.- 7594 (s. -/ 420)		
<i>Perdix palaeoperdix</i>	vert. cerv. 2 - 7944 (-); humerus sin. dist. - 8523 (s. - / 250-258); tibiotarsus sin. dist. - 9689 (s. 1/250-258)	3	1
<i>Perdix</i> cf. <i>palaeoperdix</i>	coracoid sin. dist. - 6489 (-); os quadratum - 7939 (s. 2/ 20-300); phalanx dig. pedis - 7940-7942 (s. 2/ -); 7943 (s. 1/420); scapula dex. prox. - 8525 (s. -/200-230); ulna sin. dist. - 9690 (s. 1/250-258)	10	2
<i>Perix perdix</i>	phalanx dist. dig. pedis - 6479 (s. 2/250-280); 6499 (s. 2/250-280); phalanx dig. pedis - 6496-6498 (s. 2/155-165); 7947 (s. 2/ -); furcula - 7599 (s. 2/225-245)	6	1
<i>Perix</i> cf. <i>perdix</i>	os quadratum - 6474 (s. 2/ -); phalanx dig. 2 pedis 3 - 6475 (s. 2/ -); phalanx dig. 2 pedis 3 - 6476 (s. 2/ -); phalanx dist. dig. pedis - 6478 (s. 2/250-280); 6485 (s. 1/380)	5	1
<i>Perdix perdix/palaeo- perdix</i>	cmc dex. prox. - 7589 (-/290-315); os coxae dex. - 7945 (s. 2/280-300); phalanx dig. pedis - 7958 (s. 2/ -); mandibula - apex - 8920 (s. 2/ -)	3	1
<i>Coturnix coturnix</i>	scapula sin. - 8522 (s. -/250-258)	1	1
GRUIFORMES			
<i>Crex crex</i>	humerus sin. dist. - 8512 (s. -/250-258)	1	1
CHARADRIIFORMES			
<i>Tringa</i> cf. <i>stagnatilis</i>	trochlea 4 metatarsi si. dist. - 9686 (s. 2/100-120)	1	1
STRIGIFORMES			
<i>Athene noctua</i>	phalanx dig. pedis - 8521 (s. -/30-100); sternum, pars coracoidalis - 11277 (s. 1/245)	2	1
<i>Asio otus</i>	tibiotarsus sin. dist. - 7588 (s. -/290-298)	1	1
APODIFORMES			
<i>Apus melba</i>	humerus sin. prox. - 7957 (-); phalanx dist. dig. pedis - 8918 (s. -/100-120)	2	1

Table 1 (continuation)

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Num- ber of finds	MNI
PASSERIFORMES			
<i>Melanocorypha</i> sp.	cranium - pars maxillaris - 11278 (s. 2/280-300); 11281 (s. 2/220)	2	2
<i>Anthus</i> cf. <i>trivialis</i>	humerus dex. prox. - 9682 (s. 2/100-120); 9683 (s. 2/-)	2	2
<i>Anthus</i> sp.	tarsometatarsus sin. dist. - 9684 (s. 2/100-120)	1	1
<i>Parus major</i>	tibiotarsus sin. dist. - 9687 (s. 2/-)	1	1
<i>Sylvia</i> sp.	cmc dex. - 9691 (s. 2/250-280)	1	1
<i>Ptyonoprogne rupestris</i>	humerus dex. prox. - 8921 (s. 2/100-120)	1	1
<i>Fringilla montifringilla</i>	humerus dex. prox. - 8922 (s. 2/-)	1	1
<i>Loxia curvirostra</i>	humerus sin. dist. - 8519 (s. -/280-300)	1	2
<i>Coccothraustes</i> <i>coccothraustes</i>	carpometacarpus dex. prox. - 8919 (s. 2/-)	1	1
<i>Carduelis chloris</i>	cranium - pars maxillaris - 11275 (s. 1/250-258)	1	1
<i>Carduelinae</i> gen.	mandibula dex. - 11316 (s. 2/-)	1	1
cf. <i>Garrulus glandarius</i>	vert. cerv. - 6482 (s. 2/-); phalanx 1 dig. 1 pedis sin. - 7956 (s. 1/290-315)	2	1
<i>Corvus monedula</i>	os coxae sin. - 6477 (s. 2/250-280); coracois sin. dist. - 7595 (s. -/200-230); phalanx 1 dig. 1 sin. - 7596 (s. -/200-230); phalanx dist. dig. 1 pedis - 7597 (s. -/200-230); scapula sin. - 9673; scapula dex. prox. - 9674 (s. 1/250-258); carpometacarpus dex. - 9675 (s. 1/290-315); ulna dex. prox. - 9676 (s. 1/290-315)	6	2
<i>Corvus corone/fragile</i>	tibiotarsus. dex. dist. juv. - 6483 (s. 1/420); phalanx dist. dig. pedis - 7955 (s. 1/290-315)	2	1
<i>Corvus</i> sp.	phalanx dist. dig. pedis - 7603 (s. 2/-)	2	1
<i>Pyrrhocorax graculus</i>	coracoid dex. dist. - 6472 (s. 2/-); tarsometatar- sus sin. dist. - 6491 (s. 2/220); cmc sin. - 7583 (s. -/290-298); 9671 (s. 1/223-258); 9677 (s. 1/290-315); humerus dex. prox. - 7584 (s. -/290-298); humerus dex. dist. - 9670 (s. 1/223-258); cmc sin. prox. - 7934 (s. 1/92-120); phalanx 1 dig. 1 pedis dex. - 7946 (s. 1/460-480); sternum - 9672 (s. 1/223-258); tibiotarsus sin. dist. - 9678 (s. 1/250-258); tibiotarsus sin. dist. - 9680 (s. 1/250-258); femur sin. prox. - 9685 (s. 1/160-190)	14	3
<i>Pyrrhocorax</i> cf. <i>graculus</i>	tabula sterni sin. - 9679 (s. 1/250-258)	1	1
<i>Pyrrhocorax pyrrhocorax</i>	femur dex. dist. - 9681 (s. 1/223-258)	1	1
cf. <i>Pyrrhocorax</i> sp.	phalanx dig. pedis 1 - 8520 (s. -/430)	1	1
<i>Corvidae</i> gen.	phalanx dist. dig. pedis - 6480 (s. 2/100-120); 7930 (s. 1/-); 7931 (s. -/); phalanx dist. pedis - 6484 (s. 2/-); 6487 9 (s. 2/220); 7598 (s. 2/225-245);	6	1

Table 1 (continuation)

Taxa	Collection numbers (NMNHS), sounding, depth and skeletal elements	Num- ber of finds	MNI*
<i>Petronia petronia</i> Passeres fam.	coracoid sin. prox. - 7581 (s. -/120-150); phalanx dig. pedis - 7935 (s. 1/60-90); femur dex. prox. - 11293 (s. 2/280-300)		
	mandibula - apex - 11276 (s. 1/250-258)	1	1
	rostrum maxillarae - 11317 (s. 2/-); vert. cerv. - 6481 (s. 2/155-165); 6486 (s. 2/-); 6488 (s. 2/200); 6490 (s. 2/250-290); 6494 (s. 2/155-165); 7586 (-); 7948-7950 (s. 2/250-280); phalanx dig. pedis - 7587 (-); phalanx dist. dig. pedis - 9693 (s. 2/100- 120); synsacrum sin. - 9692 (s. 1/380); phalanx prox. dig. maj. sin. - 11304 (s. 2/100-120); synsac- rum - corpora vertebrorum - 11282 (s. 2/-); 11322 (s. 2/280-300); humerus sin. dist. - 11306 (s. 2/100- 120); humerus dex. dist. - 11309 (s. 2/100-120); 11318 (s. 2/-); humerus dex. prox. - 11307-11308 (s. 2/100-120); 11314 (s. 2/-); humerus sin. prox. - 11279 (s. 1/200-230); 11283 (s. 2/-); 11315 (s. 2/-); humerus sin. - 11288 (s. 1/250-258); 11313 (s. 2/-); 11321 (s. 2/280-300); coracoid dex. dist. - 11323 (s. 2/280-300); coracoid dex. prox. - 11327 (s. 2/-); radius dex. - 11298 (s. 2/-); cmc dex. - 11292 (s. 2/ 280-300); cmc dex. prox. - 11294 (s. 2/-); cmc sin. prox. - 11296 (s. 2/-); ulna sin. dist. - 11299 (s. 2/-); ulna sin. prox. - 11300 (s. -/-); 11325 (s. 2/280-300); ulna dex. - 11286 (s. 1/250-258); tibiotarsus dex. dist. - 11305 (s. 2/100-120); 11310 (s. 2/100-120); tibiotarsus sin. dist. - 11287 (s. 1/250-258); tarsometatarsus dex. dist. - 11297 (s. 2/-); 11302- 11303 (s. 2/100-120); 11320 (s. 2/280-300)	42	6
Aves indet. (sounding and depth not cited)	vert. cerv. - 6473; 6471; 7590; 7601; 7933; 7937; 7938; 8513; ulnare - 8514; tibiotarsus - 7577; 7579; 7580; 7600; 8526; vert. cerv. 2 - 7951; costa prox. - 7578; femur dex. prox. - 11324; femur dex. dist. - 7585; 11295; humerus sin. - 7602; humerus - 7952; humerus dex. prox. - 7953; phalanx dist. dig. pedis - 7932; phalanx dig. pedis - 7936; 7954; 8515-8518; 11284; os quadratum - 8923; 9694; synsacrum corp. vert. - 11280; synsacrum - pars acetab. dex. - 11290- 11291; 11319; synsacrum - pars sin. - 11442; tibiotar- sus dex. prox. - 11326; tibiotarsus sin. prox. - 11285; apex mandibularae - 11289; mandibula dex. prox. - 11311; sternum - 11301; radius dex. prox. - 11312	41	4
Total		185	55

Woodland species

***Tetrao tetrix* Linnaeus, 1758.** A resident dendrophylous species of the Boreal and Temperate zones. Prefers the endings of coniferous, light mixed woods and grassy habitats near the bogs and forest. It is spread in the Palearctic between 11° and 21°-24° N July isotherms. In the northern parts of its range chiefly inhabits the plains, while in the southern parts it occurs in the mountains up to 2000 m a. s. l. (HARRISON, 1982). As a glacial relict it is still survived in the Alps at 2500 m a. s. l. In the 19th century the Black Grouse totally reduced its range and the population number throughout Europe. A sedentary species, sometimes makes short migrations up to 17-20 km (CRAMP & SIMMONS, 1980). *T. tetrix* is an autochthonous species for the forest-steppe landscape of Eastern Europe. In the last millennium the species secondarily inhabits the forest habitats because of the deforestation and habitat devastation (VOINSTVENSKIY, 1960; GOLOVANOVA, 1975; NAZARENKO, 1957). Dense bushes and steppes were among the preferred habitats of the species in the SE Europe (KIRIKOV, 1959). COUTURIER & COUTURIER (1980) summarise that during the Pliocene (perhaps these authors have in mind the Pleistocene - Z. B.) the Black Grouse was widely spread in Europe. BRODKORB (1964) lists more than 80 Quaternary sites, 9 of them of Pleistocene. Most of these sites are located in the present range of *T. tetrix*. Some of the Holocene sites (Neolithic and Bronze Age) are far beyond the present range (Malta, Spain, Monaco). TYRBERG (1997) lists a total of 255 Pleistocene sites: 3 of Early Pleistocene; 23 of Middle Pleistocene and 229 of Late Pleistocene. COUTURIER & COUTURIER (1980) state that the considerable reduction of the species' range in Europe begins during the Holocene. Following the more recent data (SCHMITZ, 1997), several nesting sites still survived in the NW of Macedonia and Montenegro. Data about its recent southernmost distribution in E Europe (VOOUS, 1960; MAKATSCH, 1974; CRAMP & SIMMONS, 1980; SCHMITZ, 1997) support the assumption about its former distribution through Bulgaria. The Razhishkata Cave provides the 3rd Pleistocene record of *T. tetrix* from Bulgaria. The Black Grouse was established also in the Late Pleistocene deposits of the Mirizlivka Cave (BOEV, 1997) and the Cave No 16 (BOEV, 1999a).

***Bonasa bonasia* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Inhabits dense, mainly coniferous, forests with undergrowth in the mountains. The species range is limited by the 13° and 21°-22° C July isotherms. Deforestation reduced its range during the last millennia (HARRISON, 1982). Prefers old mature woods of *Picea*, *Abies*, *Pinus*, *Larix*, as well as *Alnus*, *Corylus*, *Populus* and *Betula*. It is the most arboreal tetraonid and the presence of bushes' fruits in the summer-autumn season is of considerable importance for its distribution (CRAMP & SIMMONS, 1980). The finds from the Razhishkata Cave are the first fossil record of that species, marking its distribution in the Late Pleistocene of Bulgaria. The site lies outside of the recent breeding range.

***Asio otus* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Inhabits coniferous, dense and broadleaf forests, but the 15°C July isotherm limits the breeding range northwards. It migrate irregularly in flocks (HARRISON, 1982) chiefly in the winter. Most often spread between 300 and 530 m a. s. l. (CRAMP, 1990). The present range completely coincides with the distribution of the woods of the Northern hemisphere. A typical element of the woodland avifauna in Eurasia and North America since the Pliocene (VOINSTVENSKIY, 1960). The Long-eared Owl was known until now from the Late Pleistocene of the Temnata Douпка Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Anthus trivialis* (Linnaeus, 1758).** A migratory species of the Boreal and the Temperate zones that winters in the Subtropical and Tropical zones. Occurs in the fields with scattered trees, light forests, wood edges of coniferous and broadleaf woods up to the tree-limits in the mountains (HARRISON, 1982). Summer distribution is limited by the 10°-26° C July isotherms. A terrestrial species by its feeding and nesting (CRAMP, 1989). VOINSTVENSKIY (1960) determines its origin from the open landscapes, besides its present day occurrence in the woodland habitats. It is a new (Holocene) element for the European forest-steppe avifauna (VOINSTVENSKIY, 1960). The finds from the Razhishkata Cave provide the second fossil record of that species in Bulgaria. The Tree Pipit was reported first from the Cave No 16 (BOEV, 1999a).

***Parus major* (Linnaeus, 1758).** A resident and partly migratory species from the Subarctic to the Temperate zone. Prefers old forests but also inhabits bush formations. Up to the tree-limit in the high mountains (HARRISON, 1982). Everywhere the distribution during the breeding season is limited by the 12° C and 32° C July isotherms. Terrestrial feeding on the ground in the woods has an important significance. Highly dependent from the tree-hollows for nesting (CRAMP & PERRINS, 1993). The finds (Fig. 2) from the Razhishkata Cave provide the first fossil record of that species in Bulgaria.

***Fringilla montifringilla* (Linnaeus, 1758).** A migratory species from the Subarctic and the Boreal zones. Occurs in the open conifer and birch forests and birch and willow shrub tundra along the rivers (HARRISON, 1982). The breeding range of the Brambling is confined by the 10° C and 18°-19° C July isotherms. More seldom the species inhabits the high forests. Because of its terrestrial feeding during the non-breeding season, it can survive in the regions, where the snow blanket is up to 15 cm thick. Winters in the Temperate zone (CRAMP & PERRINS, 1994). The finds from the Razhishkata Cave provide the first fossil record of that species in Bulgaria.

***Loxia curvirostra* (Linnaeus, 1758).** A resident and wandering species of the coniferous forests of the Boreal and Temperate zones. Prefers old woods. (HARRISON, 1982). Inhabits both, the inner parts of the large woods and the wood endings, most often of *Picea*, *Pinus* and *Larix*. Depends on the nearness of water sources. The food deficiency (mainly seeds of coniferous) causes irregular wander-

Table 2

Measurements of some of the Late Pleistocene avian finds from the Razhishkata Cave

Species	Bone	Collection number	Measurement	Dimension
<i>Bonasa bonasia</i>	coracoid	7591	length of facies articularis sternalis	8,8
<i>Bonasa bonasia</i>	coracoid	7591	width of facies articularis sternalis	2,6
<i>Bonasa bonasia</i>	vert. cerv. III	7592	maximum length	8,0
<i>Bonasa bonasia</i>	vert. cerv. III	7592	height in cranial end	4,8
<i>Bonasa bonasia</i>	phalanx I dig. I pedis sin.	7593	total length	8,4
<i>Bonasa bonasia</i>	os quadratum sin.	7594	maximum length	8,0
<i>Bonasa bonasia</i>	phalanx 1 dig. pedis sin.	7593	height of facies articularis proximalis	2,6
<i>Perdix palaeoperdix</i>	tibiotarsus sin. dist.	9689	maximum cranio-caudal diameter of distal epiphysis	6,3
<i>Perdix palaeoperdix</i>	tibiotarsus sin. dist.	9689	minimum cranio-caudal diameter of distal epiphysis	4,5
<i>Perdix palaeoperdix</i>	tibiotarsus sin. dist.	9689	length of pons supratendineus	2,4
<i>Perdix palaeoperdix</i>	tibiotarsus sin. dist.	9689	width of diaphysis in the middle of pons supratendineus	4,7
<i>Tringa stagnatilis</i>	trochlea 4 metatarsi sin. dist.	9686	width of trochlea metatarsi 4	1,6
<i>Athene noctua</i>	sternum, pars coracoidalis	11277	width between the processi craniolaterali	ca. 15,4
<i>Melanocorypha</i> sp.	cranium - pars maxillaris	11278	length of os premaxillare (ventral side)	ca. 5,3
<i>Melanocorypha</i> sp.	cranium - pars maxillaris	11278	maximum height os premaxillare	2,4
<i>Melanocorypha</i> sp.	cranium - pars maxillaris	11281	length of os premaxillare (ventral side)	ca. 6,0
<i>Melanocorypha</i> sp.	cranium - pars maxillaris	11281	maximum height of os premaxillare	2,6
<i>Parus major</i>	tibiotarsus sin. dist.	9687	maximum cranio-caudal diameter of distal epiphysis	2,4
<i>Parus major</i>	tibiotarsus sin. dist.	9687	maximum cranio-caudal diameter of distal epiphysis	2,4
<i>Parus major</i>	tibiotarsus sin. dist.	9687	minimum width of diaphysis	1,2
<i>Fringilla montifringilla</i>	humerus dex. prox.	8922	width of proximal epiphysis	6,3
<i>Fringilla montifringilla</i>	humerus dex. prox.	8922	width of proximal epiphysis	6,3

Table 2 (continuation)

Species	Bone	Collection number	Measurement	Dimension
<i>Fringilla montifringilla</i>	humerus dex. prox.	8922	width between tuberculum ventrale and tuberculum dorsale	5,9
<i>Coccothraustes coccothraustes</i>	carpometacarpus dex. prox.	8919	width of trochlea carpalis	2,0
<i>Coccothraustes coccothraustes</i>	carpometacarpus dex. prox.	8919	length of synostosis metacarpalis proximalis	7,8
<i>Coccothraustes coccothraustes</i>	carpometacarpus dex. prox.	8919	thickness of os metacarpale majus in the middle	1,6
<i>Carduelis chloris</i>	cranium - pars maxillaris	11275	length of os premaxillare (ventral side)	8,4
<i>Carduelis chloris</i>	cranium - pars maxillaris	11275	maximum width of os premaxillare	8,0
<i>Petronia petronia</i>	mandibula	11276	length of pars symphysialis	5,8
<i>Petronia petronia</i>	mandibula	11276	thickness in the caudal end of pars symphysialis	2,4
<i>Athene noctua</i>	sternum, pars coracoidalis	11277	width between the processii craniolaterali	ca. 15,4

ings to the South (CRAMP & PERRINS, 1994). TYRBERG (1991) summarises that during the Wurmian glacial the main population of *L. curvirostra* was concentrated in the Western Europe. The crossbills evolved in the limited spruce refuges on the Balkans, that survived by the Holocene. After the last glacial, they restored their former range in the pine forests in the NW of the continent. The finds are the 3rd Pleistocene record of the Crossbill in Bulgaria. The species was known until now from the Bacho Kiro Cave (BOCHENSKI, 1982) and the Cave No 16 (BOEV, 1999a).

***Coccothraustes coccothraustes* (Linnaeus, 1758).** A resident and migratory species of the Boreal and the Temperate zones that inhabits the broadleaf and mixed woods. Prefers wood habitats near the rivers and lakes, forest-steppes both, in the plains and the mountains. The food deficiency in winter causes migrations (HARRISON, 1982). The range in summer is limited by the 17^o C and 25^o C July isotherms. The most specialised species to *Quercus-Carpinus* woods. Also inhabits woods of *Fagus*, *Ulmus*, *Fraxinus* and *Acer* as well as the mixed woods up to the tree-limit in the mountains (CRAMP & PERRINS, 1994). An ancient species of Neogene age, highly adapted to the nut and stone fruit trees, as well as trees of large seeds. The species survived in the Pleistocene only in the suitable refugia in the S-European peninsulas (MOREAU, 1954). The finds (Fig. 2) are the first Pleistocene record of Hawfinch for Bulgaria.

***Carduelis chloris* (Linnaeus, 1758).** A resident species of the Boreal and the Temperate zones. Migratory in the Northern parts of the range. A dendrophylous species (HARRISON, 1982). A granivorous species. During the non-

breeding season inhabits various kinds of habitats. The breeding range is limited by the 14° C July isotherm (CRAMP & PERRINS, 1994). An ancient species in the broadleaf forest landscape (VOINSTVENSKIY, 1960). The finds (Fig. 2) are the first Pleistocene record of the Greenfinch for Bulgaria.

***Garrulus glandarius* (Linnaeus, 1758).** A resident species of the Boreal to the Southern parts of the Temperate zones. A typical wood bird, chiefly inhabiting the broadleaf forests. Rarely in the mixed and the coniferous forests up to the tree-limits (HARRISON, 1982). The breeding range is limited in the summer by the 14° C July isotherm. Mainly a species of the lowland. Arboreal and strongly connected to the forests of *Quercus*, *Fagus* and *Carpinus* (CRAMP & PERRINS, 1994). The species' range is in a regression during the Holocene because of the deforestation (VOINSTVENSKIY, 1960). Until now the Jay was established only from the Late Pleistocene of the Cave No 16 (BOEV, 1999a).

Openland species

***Perdix perdix* (Linnaeus, 1758).** A resident species chiefly from the Temperate zone. Inhabits wet grassy habitats (meadows, pastures, steppes, openland with scattered shrub (HARRISON, 1982). A strictly terrestrial bird of large grassy landscapes. Avoids arid, rocky and wood habitats (CRAMP & SIMMONS, 1980). During the whole Quaternary the species inhabited the steppe zone of Eurasia where penetrated in the woodland from. An autochthonous species since the Pliocene (i.e. the Pleistocene - Z. B.) (VOINSTVENSKIY, 1960). The Late Pleistocene remains of the Grey Partridge are known from the Bacho Kiro Cave (BOCHENSKI, 1982), the Temnata Douпка Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Perdix palaeoperdix* Mourer-Chauviré, 1975.** This species was described by numerous findings from the end of the Middle Pleistocene (Riss) from S France. Diagnosis: "A primitive form of genus *Perdix*, differing from the recent species *Perdix perdix* (L.) by the noticeable smaller dimensions (MOURER-CHAUVIRE', 1975; p. 107). According to VILETTE (1983) *P. palaeoperdix* was a characteristic species for the Middle Pleistocene deposits of Europe. It is considered the direct ancestor to *P. perdix* and its dimensions were smaller than these of all recent subspecies of *P. perdix*. The finds (Fig. 2) from the Razhishkata Cave also have smaller dimensions, compared with the provided metrical data by VILLALTA (1963). They are the second record of this fossil species on the Balkans. The species was known until now only from France, Greece, Spain, SW Russia (N Caucasus) and China (TYRBERG, 1998). The morphological descriptions of Bulgarian finds of that species are subject of a separate paper.

***Coturnix coturnix* (Linnaeus, 1758).** A resident and migratory species from the southern parts of the Temperate zone and the Subtropical zone. The northern limit of its range is limited by the 15° C July isotherm. Inhabits grassy areas in the plains of dry soils, meadows and semideserts (HARRISON, 1982). Avoids arid habitats and wetland. Prefers open hilly treeless terrains up to 1000 m. a. s. l. (CRAMP & SIM-



Fig. 2. Some of the Late Pleistocene avian finds from the Razhishkata Cave: a - *Perdix* cf. *palaeoperdix* (os quadratum, NMNHS 7939); b - *Tringa* cf. *stagnatilis* (tarsometatarsus sin. dist. - trochlea metatarsi IV, NMNHS 9686); c - *Parus major* (tibiotarsus sin. dist., NMNHS 9687); d - *Melanocorypha* sp. (cranium - pars maxillaris, NMNHS 11278); e - *Carduelis chloris* (cranium - pars maxillaris, NMNHS 11275); f - *Coccothraustes coccothraustes* (carpometacarpus dex. prox., NMNHS 8919); g - *Petronia petronia* (mandibula, NMNHS 11276); h - *Pyrrhonorax pyrrhonorax* (femur dex. dist., NMNHS 9681) (Photographs: Boris Andreev)

MONS, 1980). Data of SIMEONOV & BOEV (1988) show that in Bulgaria the species at present occurs up to 950 m a. s. l. The wide range of the Quail is due to its expansion in the Quaternary (VOINSTVENSKIY, 1960). The finds are the third Pleistocene record of *C. coturnix* in Bulgaria. The species was known until now from the Bacho Kiro Cave (BOCHENSKI, 1982) and the Temnata Douпка Cave (BOEV, 1994).

***Melanocorypha* sp.** The two cranial fragments (Table 1) are homologous and fully correspond to the detailed described praemaxillar fragments of *Melanocorypha* sp. by JANOSSY (1992). We have not any comparative material of the recent species of *Melanocorypha*, spread in Europe, but the comparison with the remaining genera of larks, as well as the illustrations of JANOSSY (1992, p. 15 - fig. 2) for the Early Pleistocene avifauna of Beremend, Loc. 17 in S Hungary and these ones of CASSOLI (1980, tav. 7 - 30) for the Late Pleistocene avifauna of Delle Arene Candide in N Italy allow a reliable comparison of our finds. Both authors mention that the question on the Pleistocene remains of *Melanocorypha* in Europe is still obscure, besides their presence in the cave deposits from the Late Pleistocene. The site lies within the present breeding range of *Melanocorypha calandra* (Linnaeus, 1766). The Calandra Lark is a resident and migratory species from the southern steppe regions of the Temperate zone. A typical steppe species, preferring the communities of *Artemisia*. Avoids the stony habitats (HARRISON, 1982). Less depending on water sources. Tolerates hot summer temperatures up to 32° C (CRAMP, 1988). A species of the virgin steppes in the E Europe (VOINSTVENSKIY, 1960). The finds (Fig. 2) from the Razhishkata Cave provide the first fossil record of that genus in Bulgaria.

Aquatic habitats species

***Crex crex* (Linnaeus, 1758).** A migratory species, breeding from the Boreal to the Temperate zone. Occurs in the grassy habitats, along the bogs, swamps and wet meadows (HARRISON, 1982). Mainly in the lowland. Prefers cool wet tall-grassy habitats and avoids lakes, river banks, sandy and rocky habitats (CRAMP & SIMMONS, 1980). At present a rare nesting, migratory and passage species in Bulgaria. The Pleistocene record of the Corncrake was established in the Bacho Kiro Cave (BOCHENSKI, 1982) and the Temnata Douпка Cave (BOEV, 1994).

***Tringa stagnatilis* (Bechstein, 1803).** A migratory species of the dry steppe of the Temperate zone. Nests in the wet grassy habitats near to bogs and freshwater swamps and lakes (HARRISON, 1982). Avoids salt and alkaline habitats. A rare incidental winter visitor on the Balkans (CRAMP & SIMMONS, 1983). The finds (Fig. 2) from the Razhishkata Cave provide the first Pleistocene record of that species in Bulgaria.

Rock habitats species

***Athene noctua* (Scopoli, 1769).** A resident species from the Boreal to the Temperate zone. Inhabits different habitats including rocky terrains in the

mountains, steppes and light forests (HARRISON, 1982). The most terrestrial species of the Palearctic owls. Avoids the dense wood and shrub vegetation as well as the wetland. Spread up to 2000 m a. s. l. in the Western Palearctic (CRAMP, 1989). The big number of its subspecies (15 according to HOWARD & MOORE, 1980) indicate its long evolution in the Neogene deserts of S Europe and Asia (VOINSTVENSKIY, 1960). The finds represent the first Pleistocene record of the Little Owl from Bulgaria.

***Apus melba* (Linnaeus, 1758).** A migratory species of the southern parts of the Temperate zone. Nests on the rocks of the arid mountain rocky terrains and the rocky shores (HARRISON, 1982). The 21,1⁰ C isotherm limits the species distribution (EASTHAM, 1988). Highly aerial bird that may drift away up to 600-1000 km a day from the nesting colony. Avoids wood habitats (CRAMP, 1990). MOREAU (1954 b) states that there were not suitable habitats for this species in Europe during the Pleistocene. The numerous finds of the Alpine Swift from Bulgaria (BOEV, 1999; in press) do not support such a point of view. The finds represent the second Pleistocene record of the Swift from Bulgaria. The species was first established in the Cave No 16 (BOEV, 1998; 1999a).

***Ptyonoprogne rupestris* (Scopoli, 1769).** A migratory and resident species of the southern parts of the Temperate zone. Inhabits the rocky terrains with vertical surfaces both in the lowland and the mountains up to 2200 m a. s. l. (HARRISON, 1982). Avoids shady and windy places. Depends on the nearness of rivers and streams. The species has a circummediterranean distribution in the Western Palearctic (CRAMP, 1989). The 20⁰-21,6⁰ C July isotherms limits the breeding range (EASTHAM, 1988). The Pleistocene record of the Crag Martin in Bulgaria was established in the Bacho Kiro Cave (BOCHENSKI, 1982) and the Cave No 16 (BOEV, 1999a).

***Pyrhacorax graculus* (Linnaeus, 1766).** A resident species of the Temperate zone, inhabiting the Alpine zone in the S-European mountains. Occurs in the steppe high-mountain terrains and rocky habitats up to the snow line (HARRISON, 1982). Strictly montane petrophilous species, usually above 1500 m a. s. l. Depends on the abundance of rock hollows and crevices for nesting (CRAMP & PERRINS, 1994). During the Wurmian it tolerated the cool climate better than *P. pyrrhacorax*. Its Quaternary sites are located in the foothills and the hilly landscapes (TYRBERG, 1991). From the Pleistocene deposits this species was published from the Bacho Kiro Cave (BOCHENSKI, 1982), the Temnata Douпка Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Pyrhacorax pyrrhacorax* (Linnaeus, 1758)** (Fig. 2). A resident species of the Alpine zone of the Temperate zone in Europe. Inhabits rocky habitats up to the tree line (HARRISON, 1982). Mainly occurs between 1200 and 1500 m a. s. l. A terrestrial species by its feeding (CRAMP & PERRINS, 1994). The Chough is a disappeared species in Bulgaria. The only published record come from the Late Pleistocene of the Bacho Kiro Cave (BOCHENSKI, 1982). *P. pyrrhacorax* is an indicator for the cool climate. At present 4 isolated populations survived in the

Western Palearctic. Possibly in the Wurmian they were connected each other. Many of the Pleistocene sites lie out of the recent range (TYRBERG, 1991). The numerous remains of *P. pyrrhonorax* on the Balkans (Croatia) determine it as an index-fossil for the Late Pleistocene (MALEZ-BACIC, 1979).

***Corvus monedula* (Linnaeus, 1758).** A resident and migratory species from the Boreal to the southern parts of the Temperate zone. Depends on old trees and rock massive for the nesting. Inhabits various type of habitats (HARRISON, 1982). Northwards the breeding range is limited by 12° C July isotherm. The Jackdaw is an ubiquitous and a terrestrial and omnivorous species by its feeding (CRAMP & PERRINS, 1994). VOINSTVENSKIY (1960) consider it as a bird of mountain origin that inhabits Europe since the Pliocene. The species was widely spread during the Pleistocene in Bulgaria. It is known from the Bacho Kiro Cave (BOCHENSKI, 1982), the Temnata Dupka Cave (BOEV, 1994) and the Cave No 16 (BOEV, 1999a).

***Petronia petronia* (Linnaeus, 1766).** A resident and partly migratory species from the southern parts of the Temperate zone. Inhabits open rocky terrains of scant vegetation of grasses and scattered bushes, screes, semideserts, arid steppes. Up to 2600 m a. s. l. in the southern mountains. Do not endure the competition of *Passer hispaniolensis* (HARRISON, 1982). A species of Mediterranean distribution in the Western Palearctic (CRAMP & PERRINS, 1994). The find of the Rock Sparrow from the Razhishkata Cave is the first Pleistocene record for Bulgaria. The site lies out of the recent breeding range. Until now, the species was known from the Pleistocene of France, Italy, Iraq, Israel, Spain and Ukraine (TYRBERG, 1998).

Conclusions

As seen, 39 taxa (27 species at least) are established in the Razhishkata Cave. One species (*Perdix palaeoperdix*) is fossil and two species (*Tetrao tetrix* and *Pyrrhonorax pyrrhonorax*) are now disappeared from the country. Nine species are established for the first time in the Pleistocene deposits of Bulgaria: *Tetrastes bonasia*, *Tringa stagnatilis*, *Athene noctua*, *Melanocorypha* sp., *Parus major*, *Fringilla montifringilla*, *Coccothraustes coccothraustes*, *Carduelis chloris* and *Petronia petronia*. Five other species are reported from their second Pleistocene site of the country: *Tetrao tetrix*, *Apus melba*, *Anthus trivialis*, *Garrulus glandarius* and *P. pyrrhonorax*. This determines the Razhishkata Cave as an important site for the Pleistocene history of the Bulgarian avifauna.

The nesting habitat preferences of the recorded species show a forest-steppe landscape in the surroundings of the cave. The correlation between the woodland and steppes (openland) species is 10:4, indicating the prevailing role of the forest habitats.

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Author's address:
 Dr Zlatozar Boev
 National Museum of Natural History
 1, Tsar Osvoboditel Blvd
 1000 Sofia, Bulgaria
 e-mail: nmnhzb@bgcict.acad.bg

Късноплейстоценска авифауна от Ражишката пещера, Западна България

Златозар БОЕВ

(Резюме)

От отложенията от финала на късния плейстоцен са събрани 185 костни останки, принадлежащи на най-малко 55 екземпляра птици. Видовият състав включва 39 таксона (най-малко 27 вида), отнасящи се към 7 разряда. Един вид е фосилен (*Perdix palaeoperdix*), а 26 - рецентни, два от които са изчезнали от съвременната фауна на България - *Tetrao tetrrix* и *Pyrhhororax pyrrhonorax*.

За първи път в плейстоцена на България се съобщават находките на 9 вида: *Bonasa bonasia*, *Tringa stagnatilis*, *Athene noctua*, *Melanocorypha* sp., *Parus major*, *Fringilla montifringilla*, *Coccothraustes coccothraustes*, *Carduelis chloris* и *Petronia petronia*.

Ражишката пещера е второто находище в България, където са установени плейстоценски находки на други 5 вида: *Tetrao tetrrix*, *Apus melba*, *Anthus trivialis*, *Garrulus glandarius* и *P. pyrrhonorax*. Това определя важното ѝ значение за палеоавифаунистичните сведения за страната.

Според биотопичните предпочитания на видовете, в околността на пещерата е преобладавал лесостепният ландшафт. Съотношението на горски към степни (открито-ландшафтни) птици е 10:4, което е указание за доминиращата роля на горските местообитания. Петрофилните птици са представени от 7 вида, а хидрофилните - от 2.

Симпозиум "Холарктичните копитни на плиоцена и плейстоцена", 19 - 22 септември 2000, Авиньон, Франция

Николай СПАСОВ

Симпозиумът, организиран от музея по естествена история Requien в Авиньон по инициатива на Dr Eveline Cregut-Bonnoure, събра петдесетина специалисти от повече от 10 европейски страни. Историята на тези особено "етнозначими" групи животни, обединявани под термина "копитни", от край време предизвиква особен интерес. Множеството изследвания обаче не само изясняват тяхната филогения, но и създават редица противоречия и трудности при проучването им. Плиоценските и ранноплейстоценските останки и таксони от копитните са между слабо изучените. Същевременно те са често ключови за изясняване на историята на фауните, на техните разселвания и на развитието на природната обстановка от това време. През последните години са събрани множество, все още не добре известни и осмислени данни, за еволюцията на посочените бозайници. Ето защо събирането на специалисти в тази област и обменът на информация между тях по време на симпозиума бе твърде полезно.

Особено дискутирани бяха темите за: еволюцията на плиоценските елени; влиянието на инсулацията върху еволюцията на копитните и хоботните животни; еволюцията на т. нар. "мамонтва фауна"; филогенията на Caprinae; "вечният" проблем за морфологичните разлики между масовите плейстоценски останки от *Bos* и *Bison*; миграционните процеси на фауните и видовете в Евразия, както и ролята на новите открития в това отношение в Източна и Югоизточна Европа.

От България на симпозиума бе поканен д-р Николай Спасов (НИИМ-БАН) като член на научния комитет на този форум. Той бе и съпредседател на една от сесиите. Докладът, изнесен от него, бе свързан с проучването на плиоценските бовиди, елени и коне от България и данните, които техните фосилни находки предоставят за анализиране на палеоландшафтите от тази епоха.

Biochronology and zoogeographic affinities of the Villafranchian faunas of Bulgaria and South Europe

Nikolai SPASSOV

Introduction. The Villafranchian fauna of Bulgaria

Until recently the Villafranchian in Bulgaria was scarcely studied. The only Villafranchian (Late Villanian) faunistic complex of a vertebrate fauna has been found in the cave Temnata Douпка (bore hole - IV) (POPOV, 1991). However, only Micromammalia have been reported there. Concerning Macromammalia, only some isolated and not precisely dated findings mostly of Proboscidea were registered up to the 90ies (SPASSOV, 1997b). In the 90ies some especially important Bulgarian localities of Villafranchian vertebrate fauna were studied - the Varshets and Slivnitsa ones (BOEV, 1996; POPOV & DELCHEV, 1997; SPASSOV, 1997a; 1998; SPASSOV & CREGUT-BONNOURE, 1999.). These investigations motivate an analysis of the Villafranchian in SE Europe. The continental Villafranchian fauna is a transitional one by its character. It reflects the considerable zoocenological transformations and the radical change of the forms during the transition from the heat-loving (thermophilous) Neogene fauna to the cold-loving typical Pleistocene (Quaternary) fauna. The zoogeographic position of The Balkans in the zone of migrations between Europe, Asia and even Africa makes its fossil faunas of special interest: The study of the Villafranchian faunistic complexes on the Balkans is of a great significance for the elucidating of the origin and development of this fauna in Europe.

I. The first signs of the Ruscinian/Villafranchian transition in Bulgaria and the Balkans

The Musselievo locality: The first signs of the Ruscinian/Villafranchian transition are present in Bulgaria and the Balkans with the new locality of

Musselievo. The rich Micromammalia fauna indicates that the locality belongs to MNQ15 (POPOV & DELCHEV, 1997). The preliminary list of Macromammalia (det. N. Spassov) confirms this suggestion. The taxa determined up till now (even though all of them after scarce and fragmentary remains) are:

CARNIVORA: *Vulpes* sp., aff. *Nyctereutes* sp., *Felidae* indet. - large form (*Dinofelis*?); PERISSODACTYLA: cf. *Stephanorhinus jeanvireti*, *Tapirus arvernensis*; ARTIODACTYLA: *Sus arvernensis minor*, *Cervus* cf. *pardinensis*, cf. *Procapreolus* sp., aff. *Gazella* sp.

We could add ?*Lynx* sp. (V. Popov, Inst. of zoology, Bulg. Acad. Sci. - personal communication) and aff. *Macaca* sp. (1 molar) originally announced by V. Popov as *Dolychopithecus* (POPOV & DELCHEV 1997). Among the remains there are other taxa too, being currently studied.

Vulpes sp. from Musselievo must be the earliest fox found in Europe. The find comes to a sole P⁴ (Fig. 5). This tooth is considerably smaller than P⁴ of *Eucyon adoxus*. The tooth length, hardly reaching the lower limits of the individual variation of *V. alopecoides* from the European Villafranchian, but in the same time its width completely fits in (lab.L - 10.9; Ling. L - 11.6, W. max. - 5.8). The reason for that is the relatively well shaped and lingually protruding protocone of that otherwise slender tooth. The base of the parastyle slightly protrudes frontally as in *V. alopecoides* and in contrast to the recent *V. vulpes*, but we could not speak of an obvious rudiment of the parastyle as in the Chinese fox from the beginning of the Villafranchian *V. beihaiensis* (a find of ca. 3.3 - 3 Ma) (QIU & TEDFORD, 1990). The newly described - also from MNQ15 of Turkey (Calta) - *Vulpes galaticus* (GINSBURG, 1998) seems to be larger than the Musselievo find and its protocone does not protrude lingually.

After the composition of the macromammal fauna and the appearance of the faunistic complex of the megafauna the locality should most probably be placed in the second half of the MNQ15 zone. It is even rather possible that it is not much older than Viallette (France) and Triversa (Italy). Those localities aged 3.3 - 3.2 Ma are traditionally even to this day referred to the beginning of the Villafranchian (AZZAROLI, 1977; GLIOZZI et al. 1997), but according to some recent opinions (BONIFAY, 1990; AZANZA et al., 1997) after their appearance they rather belong to the Final Ruscinian localities. Bearing in mind the strong presence of some typically forestal elements in those localities, such a suggestion seems reasonable. Both the micromammalian (POPOV & DELCHEV 1997; POPOV - in preparation), the macromammalian (mentioned here) faunas and the ornithofauna (BOEV, in press a & b) show the specific and even unique mixing of forestal and steppe elements. This probably indicates not only the presence of specific biotopes, but also starting climatic changes and a penetration of steppe elements into SE Europe by the second half - the end of the Ruscinian.

II. The biochronology of Varshets and Slivnitsa localities and the Middle and Late Villafranchian in Europe

II. 1. The Middle Villafranchian in Europe and biostratigraphic analysis of the fauna of Varshets

The Megafaunal List (Micromammalia) of the two localities (Table 1) allows their chronological orientating by the use of the available basic criteria of biochronologization: for example the well known zones for the Neogene and the Quaternary based on the Mammal faunas (i.e. zones MNQ) (GUERIN, 1982; 1990), and according to the faunistic associations (units) proposed by AZZAROLI (1977) for the Villafranchian in Europe.

The mammal megafauna of this locality demonstrates an evident similarity with localities typical for the MNQ17 zone, such as Saint-Vallier, La Puebla de Valverde (Spain), Chilhac (France) etc. After the conclusions on the morphological stages of some species, sites as Chilhac and Le Coupet were usually placed later than St. Vallier (DUVERNOIS & GUERIN, 1989). Mostly after geological considerations BOEUF (1997) puts, however, these localities before St. Vallier (see Fig. 1).

The St.-Vallier's fauna is among the best investigated Villafranchian mammal ones (VIRET, 1954; HEINTZ, 1970; MARTIN, 1971; DEBARD et al., 1994, etc.). Because of the various, abundant and well preserved material from this locality and of the detailed investigations carried there by a number of authors, the latter is appointed as the stratotype locality of the Middle Villafranchian and as the "repere" - type locality of the biozone MN 17 of Mein (= MNQ17 after Guerin's interpretation of the Neogene-Quaternary) (HEINTZ et al., 1974; MEIN, 1990; GUERIN, 1990).

The finalized recent faunistical List of the Mammals (after DEBARD et al., 1994 and with some taxonomical/nomenclature corrections of ours) includes the following forms:

RODENTIA: *Mimomys pliocaenicus*, *Castor plicidens*, *Hystrix refossa*;

LAGOMORPHA: *Oryctolagus lacosti*, *Ochotona* sp.;

PRIMATES: *Macaca sylvana*;

CARNIVORA: *Nyctereutes megamastoides vulpinus*, *Vulpes alopecoides*, *Baranogale helbingi antiqua*, *Pannonictis ardea* (P. S. - included in the List as *Enhydriactis ardea*), *Aonyx bravardi*, *Meles thoralis*, *Ursus etruscus*, *Pliocrocota perrieri* (P. S. - included in the List as *Pachycrocota*), *Chasmaportetes* (= *Euryboas*) *lunensis*, *Lynx issiodorensis*, *Viretailurus schaubi*, *Acinonyx pardinensis*, *Homotherium crenatidens*, *Megantereon megantereon*;

PROBOSCIDEA: *Anancus arvernensis*, *Mammuthus meridionalis*;

PERISSODACTYLA: *Dicerorhinus etruscus etruscus*, *Equus stenorhinus vireti*;

ARTIODACTYLA: *Sus strozzi*, *Croizetoceros ramosus medius*, "*Cervus*" *filisi*

Table 1

Check-list of the large mammals from the Slivnitsa and Varshets localities (Bulgaria)

V - Varshets; S - Slivnitsa

Taxa	Loc.
CARNIVORA	
Canidae	
<i>Canis ex gr. etruscus</i> Major, 1877	S
<i>Vulpes alopecoides</i> F. Major, 1877	V
<i>Vulpes cf. alopecoides</i>	S
<i>Nyctereutes cf. tingi</i> Tedford et Qiu, 1991	V
Ursidae	
<i>Ursus minimus</i> D. de Chabriol et Bouillet, 1827 - <i>Ursus etruscus</i> Cuv., 1823	V
Mustelidae	
<i>Martes wenzensis</i> Stach, 1959 - <i>Martes vetus</i> Kretzoi, 1942	V
<i>Pannonictis ardea</i> (Bravard, 1828)	V
<i>Vormela petenyii</i> Kretzoi, 1942	V
<i>Baranogale balcanica</i> nov. sp.	V
<i>Meles thoralis</i> Viret, 1951	V + S
Lutrinae gen.	S
Hyaenidae	
<i>Pliocrocuta perrieri</i> (Croizet et Jobert, 1828)	V
Hyaenidae gen. (non <i>P. brevirostris</i>)	S
Felidae	
<i>Lynx issiodorensis issiodorensis</i> (Croizet et Jobert, 1828)	V
<i>Panthera cf. gombaszoegensis</i> (Kretzoi, 1938)	S
aff. <i>Viretailurus schaubi</i> (Viret, 1954)	V
<i>Acinonyx pardinensis</i> Croizet et Jobert, 1828	V
<i>Homotherium crenatidens</i> (Fabrini, 1890)	S
ARTIODACTYLA	
Cervidae	
cf. <i>Cervus rhenanus</i> Dubois (= <i>C. philisi</i>)	V
<i>Cervus rhenanus</i> - <i>Pseudodama nestii</i>	S
<i>Eucladoceros senezensis</i> cf. <i>vireti</i> Heintz, 1970	V
<i>Eucladoceros</i> cf. <i>senezensis</i> ? <i>senezensis</i> (Deperet, 1910)	S
Cervidae gen. et sp. indet.	V
Bovidae	
<i>Gazellospira</i> cf. <i>torticornis</i> (Aymard, 1854)	S
<i>Gazellospira</i> sp.	V
<i>Procamptoceras</i> cf. <i>brivatense</i> Schaub, 1923	S
<i>Gallogoral meneghinii</i> (Rutimeyer, 1878)	S
<i>Pliotragus</i> cf. <i>ardeus</i> (Deperet, 1883)	S
<i>Megalovis</i> aff. <i>latifrons</i> Schaub, 1923	V
<i>Megalovis</i> sp.	S
<i>Hemitragus</i> nov. sp.	S
<i>Ovis</i> sp.	S
Bovidae gen. et sp. indet.- I	S
Bovidae gen. et sp. indet.- II	S
PERISSODACTYLA	
Equidae	
<i>Equus stenonis vireti</i> Prat, 1964	V
<i>Equus</i> cf. <i>stenonis</i> Cocchi, 1867	S

valiensis, *Eucladoceros senezensis vireti*, *Gazella borbonica*, *Gazellospira torticornis*, *Gallogoral meneghini*, *Leptobos elatus merlae*.

Very rich and well investigated is also the fauna of La Puebla de Valverde in Spain (GAUTIER & HEINTZ, 1974; KURTEN & CRUSAFONT, 1977; HEINTZ, 1978; AGUIRRE & MORALES, 1990). The List of the Macromammalia (after HEINTZ, 1978 and AGUIRRE & MORALES, 1990) includes:

PRIMATES: *Macaca* sp., *Papio* (= *Paradolichopithecus*) *arvernensis* (P.S. - nota mea N. S.: here maybe an earlier species is concerned in fact, see SZALAY & DELSON, 1979);

CARNIVORA: "*Canis*" sp. (P.S. erroneously mentioned in the List as *C. cf. falconeri*, see Spassov 1998; maybe an *Eucyon* is concerned in fact?), *Vulpes alopecoides*, *Nyctereutes megamastoides*, *Ursus etruscus*, *Pliocrocuta perrieri*, *Chasmaportetes lunensis*, *Acinonyx pardinensis*, *Lynx issiodorensis*, *Panthera cf. schaubi* (i.e. *Vitretilurus cf. schaubi* nota mea, N.S.), *Megantereon megantereon*, Felidae indet.;

PROBOSCIDEA: *Mammuthus meridionalis*;

PERISSODACTYLA: *Dicerorhinus etruscus*, *Equus stenonis*;

ARTIODACTYLA: *Gazella borbonica*, *Gazellospira torticornis*, cf. *Gallogoral meneghinii*, *Croizetoceros ramosus pueblensis*, *Cervus philisi*, *Eucladoceros senezensis vireti*.

Although the faunas of St.-Vallier and of P. de Valverde are quite similar, some distinctions between them could be found concerning the predominance of forest or steppe elements. In St. Vallier, the sylvatic elements are nearly as numerous as the steppe ones, what suggests the existence of steppes crossed by wood massives (DEBARD et al. 1994). In the P. de Valverde locality on the contrary, the steppe species are predominating, suggesting a more arid landscape (GAUTIER & HEINTZ, 1974). The absolute age of St. Vallier is estimated to 2 Ma (DEBARD et al., 1994). The geographic distance between St. - Vallier and La Puebla is not so large and the faunistic differences are probably not only biotopic. La Puebla is generally placed (after the evolution stage of some *Cervidae*) just earlier than that French locality. However, after the mentioned paleoecological data a more latter position - on the limit with the dry climate of the SCT10 could be supposed (Fig. 1). Such a statement could be reasonable if the specific zoocoenosis of the locality has not been resulted by a more southern local climate.

After the ecological interpretation of the landscape, The Varshets locality seems to be closer to the St.-Vallier one, rather than to the P. de Valverde (see next chapter). Two faunistic features give a reason to assume that Varshets (in the frames of MNQ17) represents a faunistic complex earlier than St.-Vallier (Fig. 1):

1. The find of *Gazellospira* sp. (more primitive than *G. torticornis*). Another, identical bone fragment with preserved diaphysis (large metatarsus dist. with more flat plantar surface than *Gazellospira* in general) was found by the author (undescribed material - coll. University of Lyon) in the Roccaneyra locality. The

faunal composition of this chronologically disputable French locality resembles the fauna of St.-Vallier, but with differently structured communities: species of open spaces are much better represented there. Now this locality is placed in the beginning, or in the first half of the Middle Villafranchian and of the MNQ17 zone. (After some authors - STEININGER et al., 1990, etc. - it should be placed even in the end of MNQ16). The calculation of its absolute age puts it between 2,35-2,0 Ma (BONIFAY, 1990, etc.), but, from the point of view of the faunal analysis, the first mentioned age seems to be more real.

2. The existence (see SPASSOV, 1997a) of *Nyctereutes* cf. *tingi* - a species lesser specialized than *N. megamastoides* and recently described from China (TEDFORD & QIU, 1991). This species existed in China up to the end of the Gauss chrone, i.e. up to the Early Villafranchian's end. *N. tingi* is noted recently also for the MNQ15 of Greece, in the Megalo Emvolon locality (KOUFOS, 1997). These two finds from the Balkans are the only finds known outside China so far (The Calta N. donnezani (GINSBURG, 1998) from the MNQ15 of Asia Minor is problematic). The species probably reached SE Europe, remaining there as a relict population even somewhat later than in C. Asia.

Those two finds put Varshets some earlier than St.-Vallier in the MNQ17 frames, most probably in the first half of the MNQ17 zone. This conclusion is supported by the data of the evolutionary stage of *Ursus* and *Martes* in Varshets. The Bulgarian locality seems to be approximately of the same age or most probably a little bit later than Roccaneyra, where the steppe faunistic element is better represented and where *Hipparion* is still existing as a relict genus (Fig. 1) (SPASSOV, 1997a; 1997b).

II. 2. The Late Villafranchian in Europe and biostratigraphic analysis of the fauna of Slivnitsa

The faunal differences between Varshets and Slivnitsa (Table 1) are based upon ecological and chronological reasons. Most conforming are some carnivorous species, which is connected with the greater adaptation ability of most carnivores.

The Biochronological position of Slivnitsa needs a discussion on some well known "reper"- type localities from Europe, such as Seneze and the localities from the Olivola Unit, which Slivnitsa is similar to (SPASSOV, 1995; 1997a; 1997b; 1998).

The position of Seneze locality. The total list of the Macromammalia in this rich and well explored locality appears as following (the list follows that of HEINTZ et al., 1974, with additions and corrections after the papers of MARTIN, 1973; EISENMANN, 1980; SZALAY & DELSON, 1979; DUVERNOIS & GUERIN, 1989, and BOEUF, 1997, with several corrections of mine concerning the synonymy):

PRIMATES: *Paradolichopithecus arvernensis*, *Macaca cf. florentina*;

CARNIVORA: *Nyctereutes megamastoides*, *Vulpes alopecoides* (?), *Canis cf. arnensis* (= *Canis senezensis* - see the chapter about *Canis* from Slivnitsa and the "Wolf event"), *Ursus etruscus*, *Pliocrocota perrieri*, *Chasmaportetes lunensis*, *Acinonyx pardinensis*, *Megantereon megartereon*;

PROBOSCIDEA: *Mammuthus (Archidiskodon) meridionalis*;

PERISSODACTYLA: *Equus stenonis "senezensis"*, *Equus major* (= *E. bressanus*), *Dicerorhinus etruscus*;

ARTIODACTYLA: *Sus strozzi*, *Croizetoceros ramosus minor*, *Cervus philisi philisi*, *Eucladoceros senezensis senezensis*, *Cervalces (Libralces) gallicus*, (?*Gazella borbonica*), *Gazellospira torticornis*, *Gallogoral meneghinii*, *Pliotragus ardeus*, *Procamptoceras brivatense*, *Megalovis latifrons*, *Leptobos etruscus*, *Leptobos furtivus*, "*Ovis*" sp. (about the latter species see somewhat below).

The stratigraphic position of Seneze is very controversial. Some faunal finds make several authors suggest there a mixt fauna or two Villafranchian levels in the locality (SCHAUB, 1944; V. EISENMANN, N.M.N.H. - Paris: personal communication). However, other detailed investigations lead to the opinion that the Seneze assemblage is homogenous; only the findings of "*Ovis*" and one of the *Equus* could possibly be refereed to an upper horizon (C. GUERIN, Univ.-Lyon.: person. comm.).

If we accept that the locality's fauna is homogenous, two possible main decisions regarding the age of the locality could be proposed:

Var. I. Final Pliocene age: This conception is supported by the biochronological analyses of the Italian authors (TORRE et al, 1992; GLIOZZI et al., 1997). The presence of *Nyctereutes* and the lack of *Pachycrocota brevirostris* represent also faunistic arguments for such a chronological position (the lack of a species in the zoocoenosis and/or the taphocoenosis is not a direct proof for an environmental changes but it could be an important indication for it). Generally Seneze is related with the magnetostratigraphic event of Reunion. Some very recent interpretations place Reunion and Seneze earlier than 2.1 Ma (see in: GLIOZZI et al., 1997). This, however, does not seem logical from the point of view of the latest absolute age estimations of the St.-Vallier locality - 2 Ma (DEBARD et al., 1994), a locality which after its fauna is obviously earlier than Seneze. BAKSI (1993) notes that more than one Reunion Event is possible. Some other recent interpretations about the absolute dating show the following: the dating of the upper basalt layers situated just under the fossils in Seneze indicates an age of 2 Ma (end of Reunion). The fossil remains themselves should be a little bit later than that age - between Reunion and Olduvai (BOEUF, 1997).

Var. II. After another opinion Seneze should be placed in the very beginning of the Pleistocene or at least later than Olivola Unit (DUVERNOIS & GUERIN, 1989; BONIFAY, 1990; C. GUERIN - person. comm.). Such a chronological position - lather than Olivola unit could be supported partially by the presence of a horse (one of

the three species in the locality) close to the horse of Farneta (V. EISENMANN, pers. comm.). The above mentioned opinion concerning the Seneze biochronology could be related also with the placement of Tasso unit more close to the Middle Pleistocene boundary because of the appearance of *Hippopotamus* (C. GUERIN - pers. comm.). However the first appearance of this genus just in post-Olduvai time is possible especially having in mind the climatic stages - SCT 9 of ZUBAKOV & BORZENKOVA (1990) for the Tasso time (see the place of SCT9 - warming;- Fig. 1-2).

The Olivola unit. These localities as a whole, (and Slivnitsa as well) are characterized by the existence of lots of *Bovidae*, together with *Canis* and also *Panthera gombaszoegensis*. The faunal list of the Macromammalia of the Matassino includes following species (after TORRE et al., 1993):

CARNIVORA: *Canis etruscus*,

PROBOSCIDEA: *Mammuthus (Archidiskodon) meridionalis*,

PERISSODACTYLA: *Equus stenonis*, *Dicerorhinus etruscus* (found in the neighbourhood);

ARTIODACTYLA: *Sus strozzii*, *Pseudodama nestii*, *Eucladoceros dicranios*, *Leptobos etruscus*.

The Faunal list of Olivola loc. is as follows (ALBERDI et al., 1998):

CARNIVORA: *Canis etruscus*, *Ursus etruscus*, *Enhydriactis ardea* (i.e. *Pannonictis ardea* - nota N. S.), *Chasmaportetes lunensis*, *Pachycrocuta brevirostris*, *Homotherium crenatidens* - *H. ex. gr. latidens*, *Megantereon cultridens* (i.e. *M. megantereon* - nota N.S.),

?*Acinonyx pardinensis*, *Lynx issiodorensis*, *Panthera gombaszoegensis*

PROBOSCIDEA: *Mammuthus meridionalis meridionalis*

PERISSODACTYLA: *Stephanorhinus etruscus*, *Equus stenonis*

ARTIODACTYLA: *Sus strozzii*, *Eucladoceros dicranius olivolanus*, *Pseudodama nestii*, *Leptobos etruscus*, *Leptobos ex gr. merlae* - *L. furtivus*, *Gallogoral meneghinii*, *Procamptoceras brivatense*

This unit is generally related with the beginning of the Late Villafranchian (AZZAROLI, 1983; TORRE et al., 1992; 1996). Up to now the sites of Olivola Unit were placed just in the beginning of the Pleistocene, but recently this unit was placed just at the end of the Pliocene or on the Plio-Pleistocene boundary (TORRE et al., 1993; 1996; GLIOZZI et al., 1997). According to the decisions of the XII INQUA Congress, the Neogene/Quaternary boundary should be placed a little later than the end of the Olduvai subchrone in the Vrica marine section. (Italy). The end of Olduvai is calculated at 1.65 Ma but recently at 1.78 (BAKSI, 1993; TORRE et al., 1996) and the beginning of the pleistocene at ca. 1.76 (BAKSI, 1993). Some modern investigations on the palaeomagnetism suggest that the boundary between the Middle- and the Late Villafranchian in Europe marked after correlation of the sediments from the Matassino locality in Italy (as a marker of the Late Villafranchian Beginning, being a typical locality from the Olivola unit) is

situated in the upper portion of the Olduvai subchrone (Upper Pliocene), or immediately after its end (the Beginning of Pleistocene) (TORRE et al., 1993; TORRE et al., 1996) This locality could be referred to the End of Olivola unit or to the transition between Olivola and Tasso units (GLIOZZI et al., 1997).

Faunal and biochronological comparisons with Slivnitsa. Especially remarkable is the similarity of Slivnitsa megafauna (Table 1) with the fauna of Seneze (SPASSOV, 1997a; 1997b; 1998) The fauna of artiodactyls from Slivnitsa (for Bovidae determination - see SPASSOV & CREGUT-BONNOURE, 1999), as well as the presence of *Canis* and *Panthera*, suggests similarities with the localities from the Plio-Pleistocene boundary or the very Beginning of the Pleistocene - e.g. Olivola, Matassino (Olivola "Unit"). Therefore *P. brevirostris* existing for the first time in Europe in Olivola Unit is still not present in Slivnitsa, as it was mentioned above. At the same time tooth morphotypes of the Microtinae correspond to a stage of evolution which must be looked for close by the Plio-Pleistocene boundary, but earlier than this boundary: 1. Absence of *Allophaiomys pliocaenicus*, *M. deucalion* and *Lagurus arankae*, 2. Presence of an morphotype of *Mimomys tornensis* corresponding to a stage of evolution connected with the Plio-Pleistocene boundary but more exactly with the time before this boundary (V. Popov; Zool. Inst., Sofia - pers. communication).

The prevailing hoofed mammals of open spaces (xerophytisation) suggest also that the fauna of Slivnitsa locality should have existed still before the Olduvaian warming, i.e. before the date 1.9 Ma and during the cooling known from Georgia as Meria (2,0-1,82/1,86 Ma ago) (ZUBAKOV & BORZENKOVA, 1990).

So the Micromammalian data and the characteristics of the Macromammalian megafauna of Slivnitsa (predominance of *Bovidae* on *Cervidae*, presence of the genera of *Panthera* and *Canis*, presence of *Hyaenidae* but not of *Pachycrocuta brevirostris*) enable the establishing of rather narrow chronological boundaries of the time the locality's fauna should be referred to - just at the end of Pliocene, between the localities from the end of the MNQ17 (St.-Vallier, Chilhac) and those from the Plio-Pleistocene boundary (Olivola "Unit") (Fig. 1-2). Thus, the Slivnitsa locality should be placed into the Costa St. Giacomo unit and in SCT10. The zone MNQ18 should have started after 2,0 Ma. - in the end of Pliocene and not in the beginning of Pleistocene (see below). Slivnitsa must be placed at the beginning of this zone too (Fig. 1-2). If a nearly equal age of Slivnitsa and Seneze is accepted (in case of the pre-Olduvai interpretation of the Seneze age - see above), Slivnitsa could be somewhat older of both however: An old *Hemitragus* - *Hemitragus* sp.nov., is present in Slivnitsa. This is a species whose remains closely resemble the finds of that Genus in Villany 3 (SPASSOV & CREGUT-BONNOURE 1999). Villany 3 is referred to MNQ17, but it evidently envelopes a longer period (see below), so that several finds, including *Hemitragus*, correspond to the level of MNQ18's beginning and to C. S. Giacomo unit (op. cit.).

Several faunal resemblances (see, *Canis*, *Panthera* and the bovids) exist between Slivnitsa and Gerakarou (Greece). But Gerakarou could be something later in age than Slivnitsa (see next chapter), where *P. brevirostris* is not present in the fossil sample (about 1000 bones). (Fig. 2).

II. 3. Biochronology of the Villafranchian in Europe. Specifying, addition and correlation of the biochronologic criteria concerning the Middle and Late Villafranchian

An important circumstance by modern biozonation is the constant accumulation of new data about the composition and characteristics of the fauna, resulting in an outdating of the biochronologic criteria. Repeated suggestions were made recently to update the subdivisions of Villafranchian (KOSTOPOULOS & KOUFOS, 1995; KOSTOPOULOS, 1996). Also, there are new efforts to update the chronology of Plio-Pleistocene mammal faunas (AZANZA et al., 1997). The biochronologic division of the West Mediterranean Plio-Pleistocene by those authors was based on multivariate analysis of faunal similarity and was an attempt to objectively define the boundaries of biotic events in the evolution of mammal faunistic associations in time. The general frameworks set by this analysis agree more or less with the existing concepts. Distinctions come when comparing the basic faunistic units of this new biochronologic scheme with the generally used Mammal units - those of MEIN 1975; 1990 (with the contribution made by GUERIN 1982; 1990), those of the Italian school (AZZAROLI, 1977, TORRE et al., 1992 etc.), and those of AGUSTI et al. (1987). Although the faunistic microunits C and D by AZANZA et al. (1997) reflect well the boundaries and stages of the main current faunistic events, they are not precise enough to clarify the details in the faunal evolution process. So, merging the Italian school's Olivola and Tasso units, if reasonable from the point of view of following the main stages of the faunas evolution, permits no detailed tracing of the successions. The difference between Olivola and Tasso after the latest existing species or genera (*Chasmaportetes* - Olivola), or after the first appearance by a number of Macromammalia ("*Leptobos*" *vallisarni*, *Hippopotamus*, *Canis falconeri* etc. - Tasso unit), is obvious enough (see AZZAROLI, 1983; TORRE et al., 1992).

Thus, despite this modern approach to the biochronology of mammal faunas, the "old" and more detailed "MNQ zones" and "faunal units" don't lose their meaning. Contrary to some opinions, those two different systems of biochronology could be successfully correlated. A complex method (MNQ zones/Faunal units) of Plio-Pleistocene biochronology would turn helpful for a more detailed study of Villafranchian successions and also for an after division of the Villafranchian and setting the boundaries of its stages.

However, the effective use of the two methods is possible only after updating the definitions and boundaries of the MNQ zones and the faunal units concerning

the Plio-Pleistocene having in mind the recent faunal data.

An example of the necessity of updating could be given with the Villafranchian MNQ-zones 17 - 19. These zones are of a special importance as far as they are connected with the evaluation of the faunal events on the Pliocene-Pleistocene boundary.

1. The definition of zone MNQ19 (GUERIN, 1982; 1990) includes, for example, the appearance of *Canis etruscus*. This appearance is connected after TORRE et al, (1992) with the localities from the "Olivola unit", placed recently near the Plio-Pleistocene boundary (the age of the localities Olivola-Matassino has been estimated recently at ca. 1.8 Ma., see TORRE, et al., 1996, GLIOZZI et al., 1997) (Fig. 1). We see, however, that this species enters Europe probably earlier, still in Slivnitsa (SPASSOV, 1998). In fact, what is important here is not the appearance of this exact species, but something more - the so called "*Canis event*": the penetration in Europe of the wolf-like *Canis* (AZZAROLI, 1983; TURNER, 1992; TORRE et al., 1992; ROOK & TORRE, 1996). That event is obviously earlier than Olivola (and Seneze?) after the Slivnitsa data and should be connected with the final Pliocene.

C. "senezensis", found in Seneze, which has large diastemae between the premolars could be referred to *C. arnensis*, resembling the latter also after its size. Indeed, *C. arnensis* was not found until recently earlier than Tasso (Italy), but KOUFOS (1987) has announced it from Gerakarou (Greece). The age of the Gerakarou locality, where *Pachycrocuta brevirostris* is present as well, is probably at the boundary between Seneze and Olivola units (see below). All that suggests that the appearance of *C. etruscus* and the "*Canis event*" in general should now be placed in the definition of the MNQ18 zone.

2. At the same time, the definition of the MNQ18 includes also the appearance of *Allophaiomys pliocaenicus*, *Procamptoceras*, *Megalovis*. Now we know that *A. pliocaenicus* invaded Europe ca. 1,6 Ma ago. This is a time considerably later than the time of the appearance of *C. etruscus* and *Canis s.str.* in general, as well as the time of appearance of *Procamptoceras* and *Megalovis* after the recent data. *Procamptoceras* is already established also in MNQ17 (DUVERNOIS & GUERIN, 1989), and, after the investigations in Varshets, *Megalovis* was inhabit Europe also since MNQ17 (SPASSOV & CREGUT-BONNOURE, 1999; SPASSOV, 1997a).

The fauna characteristic for Costa St. Giacomo Unit of GLIOZZI et al. (1997) (= "Seneze" faunal unit of TORRE et al., 1992) is a Pliocene (Final Pliocene) one. Nevertheless, the "physiognomic" differences between the faunas of the "St.-Vallier (including Varshets) Unit" and of the "C. st. Giacomo Unit" (including Slivnitsa) are greater than the differences between the latter faunal unit and the faunas from Late Pliocene boundary and the beginning of Pleistocene (Olivola - Matassino). The aridification, having taken place in the period between St.-Vallier/Varshets and C. St. Giacomo/Slivnitsa, has resulted in the above mentioned intensive penetration of *Bovidae* (*Caprinae*) and of the open spaces carnivores, such as the modern wolf-like *Canis ex gr. etruscus* and *C.*

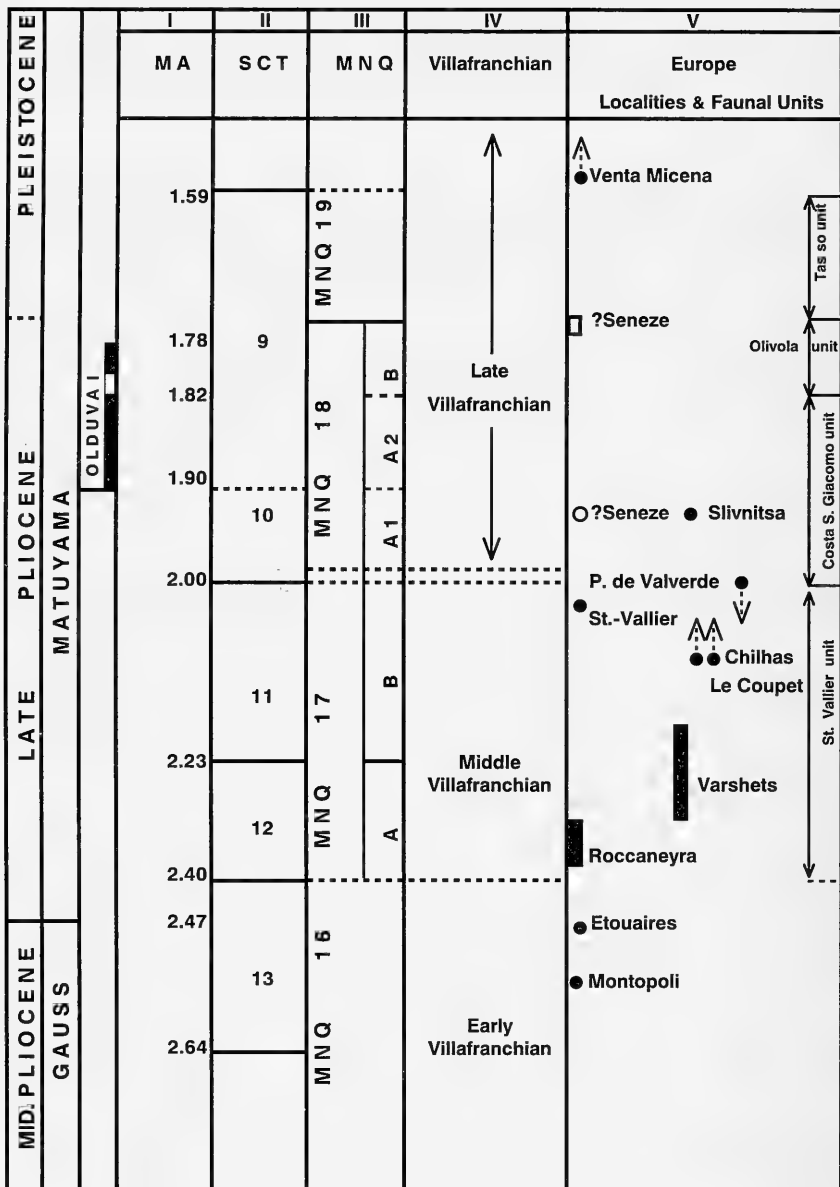


Fig. 1. - Biochronology of the Villafranchian localities of W. Europe. Correlation of the climatic and faunal events (after Spassov, 1997-a ; 1997b; 1997c, with additions and modifications): Column I - Geochronology, Absolute age and magnetostratigraphy; Column II - Climatic stratigraphic subdivision (superclimathemes - SCT) of Zubakov & Borzenkova with minor modifications. Column III - Mammalian biozones of Guerin; Column IV - The Villafranchian subdivision; Column V - Major localities and the Faunal Units of Azzaroli - Gliozzi et al. 1997 (see the text). For the controversial position of Seneze - see the text.

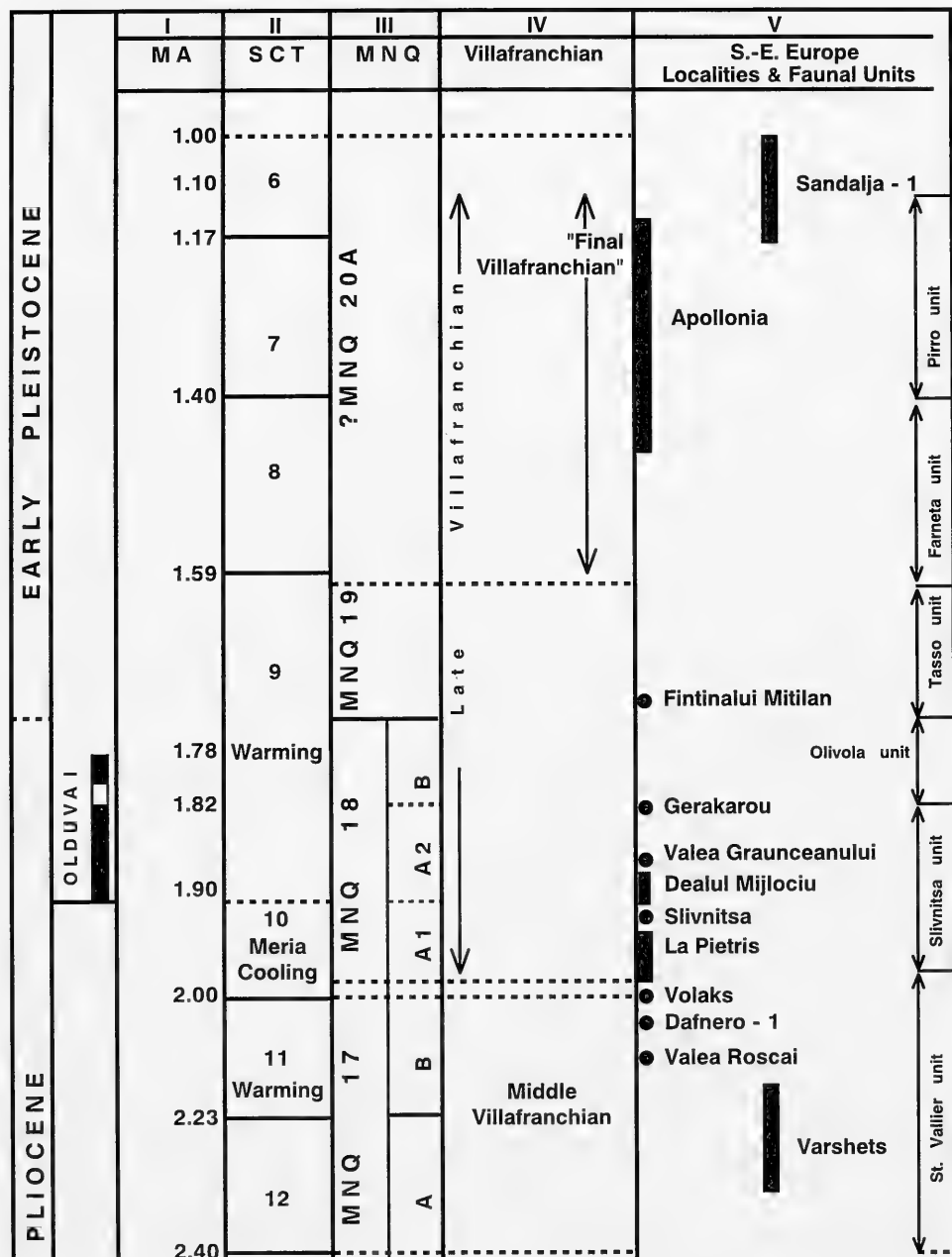


Fig. 2. Biochronology of the Villafranchian localities of S-E. Europe. Correlation of the climatic and faunal events (after Spassov, 1998 , with additions and modifications. (The explanations as in Fig. 1).

P.S. The biochronologic positions of localities as Roccaneyra, Varshets, La Pietris, D. Milociu, Apollonia & Sandalja 1 are presented within probable ranges.

"*senezensis*" and *Panthera gombaszoegensis*. The general outlook of this more "steppe" fauna becomes just confirmed in the period between C. St. giacomo and Gerakarou/Olivola by the appearance of some species (e.g. of *Pachyrocuta brevirostris*). (Indeed, *P. brevirostris* is found in the Hapry faunal Complex of the Sea of Azov region - South Russia, whose age is referred to the beginning of MNQ17. Its presence there, however, could be a result of: 1. The direct contact with Asia; 2. The possible presence of younger layers (SOTNIKOVA et al., 1998)).

Seneze remaining the type locality of MNQ18 (GUERIN, 1982) we can attach to this zone also the localities from the Plio-Pleistocene boundary - such as Olivola - creating the subzone of MNQ18-b (appearance of *P. brevirostris* - see MASINI & TORRE, 1990) (Fig. 1). In the MNQ18-a1 we could place the Pre-Olduvai localities, with their physiognomy determined by species adapted to a more arid environment. In the MNQ18-a2 could be placed the Pre-Olivola localities (see Fig. 1-2) corresponding to the Olduvai subchrone, with a fauna requiring a more humid climate again. As a result, we can correlate the "Costa St. Giacomo unit" of Italian school with the first phase of Guerin's MNQ18 (=MNQ18a of this paper). Thus the MNQ18a (=C. St. Giacomo unit) would include a drier initial period - MNQ18-a1 (=SCT10 of Zubakov et Borzenkova - cooling) and a more humid final period - MNQ18-a2 (=Olduvai episode, =SCT9 first phase - warming). (maybe not only the MNQ-zones but also some of the boundaries of the SCT-zones - e.g. SCT9's boundaries - need to be updated).

The opinion that the Late Villafranchian starts from the very beginning of the Pleistocene sounds plausible and is broadly accepted (MASINI & TORRE, 1990). It seems although that it is not exactly the case. Several facts show that the beginning of some typically Late Villafranchian phenomena have started yet in the End of Pliocene. Indeed the considerations mentioned above on Slivnitsa and Gerakarou fauna permit some new statements concerning the faunal changes to be suggested: faunal events usually considered typical for the beginning of Pleistocene in Europe (BONIFAY, 1990; TURNER, 1992) start in fact as early as the end of the Pliocene, especially in the eastern regions of the continent. Such phenomena are, for instance, the obvious development of the *Bovidae* (*Caprinae*) faunas and their prevalence over *Cervidae*, as well as the migration from the East (S-East) of the *Panthera* and *Canis* genera on the continent (see below). The find of *Canis* in Slivnitsa gives the explanation of the possible Early Pliocene appearance of *Canis* s. str. in the Seneze locality and could be an argument supporting the statement that the faunal composition in this French locality is rather homogenous. The beginning of the Late Villafranchian could be placed not in the Pleistocene's beginning but in the end of the Pliocene (zone MNQ18a = C. St. Giacomo unit, with localities like Slivnitsa) (Fig. 1-2).

II. 4. The problem of the correlation of the Western and Eastern European Villafranchian and biochronology of the localities from the adjacent territories

It was already noted that there is a logical tendency to correlate stratigraphically the biocomplexes in Eastern and South Eastern Europe and even in Central Asia with those earlier defined in W-Europe by using the same biostratigraphic criteria. The use of locally created criteria over much vaster territories, however, might cause some mistakes. Also disputable are the various methods of biozonating created (see the analysis in GUERIN, 1990). Some of the main problems of biozonating concern the temps and synchronization of the variability of the faunas, as well as the related question of the zoogeographic particularities of the local faunas.

We have to note that the rate of faunal changes is different with:

1. occupation of new environmental territories;
2. migrations and spreading of the faunas over new territories which propose the same or similar living conditions. The latter are usually at a specific or subspecific level (SPASSOV, 1997 c).

Casus 1. The occupation of new territories with an environment different from that typical for the taxa takes place in global natural changes associated with a considerable growing of certain biomes, or even with a creation of new ones. The settlement of new territories in such cases is based on pre-adaptation and is connected with an evolution of the taxa in time (usually on supraspecific level). Such a penetration into the new environment cannot happen instantly and is usually connected with new anamorphic accommodations and an impetus to the morphologic evolution of the groups. Such is the case, for example, with the aridification of N-America and C. Asia starting in the end of Eocene and actively continuing during the Oligocene. Those changes have given an impetus to the development of a number of "cursorial" *Tapiroidea* and *Rhinocerotidea*, invading into the savanna from a forestal environment. Such type of distribution is slow enough and well detected by the geological annals.

Casus 2. Such distributions, associated mostly with the spacial adaptive radiation, usually do not result in evolutionary changes or changes on a supraspecific level. In this case it is almost not necessary for the species and faunas to accommodate towards the new living conditions, so in fact they simply enlarge their areals. This happens with forest species when a new deforestation has taken place, or with steppe species after an aridification of the climate or after the disappearance of a geographic barrier (e.g. formation of landbridge between two mainlands separated by water). In this case the distribution is rather fast - in fact instant from the point of view of geologic events (VANGENHEIM, 1977; FLYNN et al., 1984). The "dispersal events" of the Villafranchian faunas over the territories of today's Palaearctics should be referred to that case.

Thus, the use of the zonation criteria of the Neogene-Quaternary, including the W-Europe Villafranchian for the whole continent and even for still vaster territories, is possible. However, the following should be had in mind:

Considerable differences are possible when comparing distant territories because of: 1. Existence of local faunas; 2. Penetration of certain species in the Eastern or Southern regions of Europe only (not so rapid dispersal of certain species, especially rodents is also rather possible. Such kind of relatively slow invasion could be accompanied by an asynchrony, if even slight, in the existence of the same species in W and E. Europe); 3. Retreat of the faunas and their relict existence in certain places long after their disappearance in vast territories.

Examples of such differences are numerous. So in the recent fauna of S-E Europe, *Mesocricetus newtoni*, *Cricetulus migratorius*, *Talpa levantis*, *Mustela eversmanni*, *Vormela peregusna* etc., existed during the whole Holocene, without penetrating to the West. New data shows (KOSTOPOULOS, 1996;1998; KOSTOPOULOS - in press) that the Villafranchian *Bovidae* fauna of Greece includes forms known particularly from the Circumpontic zone and Fore Asia, but not from the other regions of Europe; The *Cervidae* species from the Late Villafranchian of Italy are taxonomically quite different from those of Spain and France (see HEINTZ, 1970; AZZAROLI, 1983); *Nyctereutes* disappears in Europe as early as the end of Pliocene or the Pliocene/Pleistocene boundary . At the same time, in neighbouring to Europe palaeartic territories such as Palestine, this genus exists up to the End of Pleistocene (today it exist in natural conditions only in the Ussuri region); *Megantereon* also disappears in most of the territory of Europe (as already noted) as early as the very Beginning of the Pleistocene However, (see above) this genus survived in the Mediterranean - Apollonia, Greece and Farneta to Pirro unit, Italy, Spain (TURNER, 1992; KOUFOS et al., 1995; GLIOZZI et al., 1997) - almost up to the End of the Early Pleistocene (the End of Late Villafranchian). The genus survived in Asia probably to the beginning of the Middle Pleistocene (WERDELIN & TURNER, 1996). Similar examples are also the existence of the lion in the Holocene only in SE-Europe, as well as the retreat of the leopard from Europe, and its surviving in the Holocene of the continent only in Caucasus.

II. 5. The biochronology of the Villafranchian localities in South-Eastern Europe

The problem of precise biochronology of Villafranchian in SE-Europe could be elucidated by comparison of the faunas existing there with those of the well known Central, and above all, West European localities. The reason is, the biostratigraphical criteria have been created namely on the base of their relatively high level of investigation in those regions. Some views concerning the biostratigraphy of some of the principal localities of W-European Villafranchian

have been cited above.

Concerning the analysis of some of the localities in SE-Europe it is worth discussing the biostratigraphy of the well known Central European Villafranchian localities near Villany.

Villany 3-5, Hungary

The Plio-Pleistocene localities near Villany became famous all over the world thanks to the meticulous and rather contributive investigations carried out by a number of researchers (KORMOS, 1937; KRETZOI, 1956; JANOSSY, 1986). It is not accidental that the biostratigraphic concept "Villanian" is broadly used in many investigations as an equivalent of "Villafranchian". The stratigraphic position of the localities Villany-3 and Villany-5 is of certain importance for the present study. These two localities are practically equal in age, the second one maybe a little bit closer to the present time - see JANOSSY (1986), and some authors (MONTUIRE, 1994) estimate the age of Villany-5 at ca. 1,8 Ma. The modern faunistic lists of these localities are presented by JANNOSY (1986). The first of them - Villany-3 (= Villany-Kalkberg-Nord) is the richer one. After the broadly accepted opinion, its fauna belongs to the St.-Vallier Unit - zone MN17 of Mein (BRUIJN et al., 1992)p i.e. - to the Middle Villafranchian. It should be noted, however, that this zone in fact includes the MNQ17-18 zones in Guérin's interpretation, i.e. Late Pliocene up to its end (incl. the beginning of the late Villafranchian). Here we could place the Seneze unit, too, as it was already said. A proper question is if Villany-3 is limited by St.-Vallier unit, or concerns later faunal events as the Seneze unit (MNQ18 sensu Guérin), i.e. MNQ 18-a after the biozonation suggested in this work.

JANNOSY (1986) does not close Villany-3 in narrow frames and places it chronologically in the time between 2 and 1.5 Ma ago. Supporting that suggestion of JANOSSY (op.cit.), RADULESCO & SAMSON (1990) also note that the fossil bearing layers in Villany 3 are probably corresponding to a rather long period of time, with more than one faunal associations included there. The rather complicated geology of that karst locality appears to confirm such an opinion. Indeed, a number of forms listed in the locality - "*Leo* cf. *gombaszoegensis*", "*Canis mosbachensis*" (= *C. etruscus*), *Vulpes* (?) *praecorsac*, etc. - probably suggest an age not earlier, and maybe even somewhat later than Seneze and Slivnitsa (see corresponding Chapter above for more detailed information about the migrations of *Canis* s.str. and *P. gombaszoegensis*). The teeth of *Hemitragus* from Villany (Villany 3 ? - see JANOSSY, 1986; *Hemitragus* cf. *bonali*), kept in the old collections, are identical with the teeth from Slivnitsa (SPASSOV & CREGUT-BONNOURE (1999)). Probably we have there fossils of similar age/taxon, which could be connected with the migrations from the East during the cooling in the superclimatheme SCT10 of Zubakov et Borzenkova (see Fig. 2).

Southeastern Europe

Romania: The Villafranchian fauna from the Oltet valley (Oltenia)

Some of the most interesting Villafranchian localities in Romania are concentrated in the regions of Tetoiu and Irimesti, the Oltet valley, and represent a successive Villafranchian fauna whose biostratigraphic state has been precisely analyzed by RADULESCO & SAMSON (1990; 1995). If comparing the Oltet sites with Varshets and Slivnitsa and having in mind the biostratigraphy discussed above, the localities from the lower horizon of Tetoiu and from the middle horizon of Tetoiu and Irimesti are of a special interest (Fig. 2).

RADULESCO & SAMSON (1990) conclude that the lower horizon could be correlated with the upper section of the MN17 zone of Mein (the Saint-Vallier zone). We have to stress again, however, that the MN17 zone includes both MNQ17 + MNQ18 zones (sensu Guerin). Or, the MN17 zone includes both the St.-Vallier unit and localities from the very End of Pliocene - later than St.-Vallier unit and with different faunal features: the Seneze unit (MNQ18-a in our interpretation) (Fig 1-2). The statement of RADULESCO & SAMSON (1990) could finally be interpreted as follows: the Lower Villafranchian horizon in the Oltet valley probably includes the End of MNQ17 and the localities later from St.-Vallier (the final phase of the Pliocene). We could also accept that conclusion. The latter could be confirmed and specified by comparing those Oltenian sites with Varshets and Slivnitsa having in mind our concept of the MNQ18 zone.

A. Lower horizon (Tetoiu region). The stratigraphy of the lower horizon of Tetoiu reveals the following succession of the localities with Villafranchian mammal fauna (see RADULESCO & SAMSON, 1990): Valea Roscai (the earliest one); La Pietris; Valea Graunceanului.

Most probably, Valea Roscai is approximatively corresponding to the level of the St.-Vallier locality. *M. (Archidiskodon) meridionalis* shows there some primitive teeth features (RADULESCO & SAMSON, op. cit.).

The later locality from that horizon - LA PIETRIS - shows the presence of several Villafranchian forms which disappear in Europe before the beginning of Pleistocene - *Nyctereutes megamastoides*. We must therefore accept that the locality is earlier than the Olivola unit, where the raccoon-dog has already disappeared. As it was already noted, the beginning of that biochronologic unit is situated in the very beginning of Pleistocene or most probably at the very end of Pliocene (i.e. at the Plio-Pleistocene boundary). *Pliotragus ardeus* is present in La Pietris, and horses prevail over deer - an indication of a more arid landscape. All these facts and especially the last one give reason an age similar to that of La Puebla to be proposed; i.e. the same age as that of the Mid/Late Villafranchian boundary (the SCT11/SCT10 boundary), or more probably, that of Slivnitsa - SCT10 (= MNQ18-a) (Fig. 2).

VALEA GRAUNCEANULUI. The Villafranchian raccoon-dog is still present here which shows that the locality is still a Pliocene one. The fauna of the locality includes also *Pliotragus ardeus* and *Papio (Paradolichopithecus) arvernensis geticus*. It is worth noting that the co-existence of these two forms is typical for MNQ18-a (sensu the biostratigraphy proposed in this study) (i.e. the Costa St. Giacomo unit). However, Valea Graunceanului seems to be a locality later than Slivnitsa (a presumption made also by RADULESCO & SAMSON, 1990 concerning Seneze, in the pre-Olduvai understanding of the age of this site). Thus V. Graunceanului appears to be later than MNQ18-a1 due to following reasons: the deer prevail over the other hoofed mammals, and, at the same time, *Castor* is also presented there. This not only indicates biotopes more humid and forestal than those of La Pietris, but also a biostratigraphic position later than La Pietris. Valea Graunceanului should be placed within the frames of the Olduvai episode. We could separate it in MNQ18-a2, an age corresponding to the age of the superclimatheme SCT9 of Zubakov et Borzenkova. This superclimatheme differs from SCT10 by a new warming (Fig. 2).

B. Middle horizon (regions of Tetoiu and Irimesti). The localities from this horizon (e.g. Fintinalui Mitilan - Fig. 2) show some faunistic elements which have appeared during the Seneze unit (*Cervalces gallicus*), but they are obviously later (probably - Early Pleistocene) because of the presence of *Pachicrocuta brevirostris* and *Trogontherium boisvilletti*. After RADULESCO & SAMSON (1990) these localities are later than Olivola too and of equal age with Tasso due to the absence of *Anancus*. Indeed, such a conclusion appears to be the most probable but recently the last *Anancus* (from Costa S. Giacomo) is placed not in Olivola F.U. but something earlier. It is possible also that in the East European habitats with more steppe conditions this species could be already replaced by the *Elephantidae*. Another explanation of the lack of *Anancus* could be its rarity in this period, i.e. the lesser probability to be found: only 3-4 species of Macromammalia have been discovered in each of these two Romanian localities. With this note, we could suggest an approximate age of the localities from the Middle horizon - from Olivola to Tasso unit.

The republic of Croatia:

THE LOCALITY OF SANDALJA I. The locality of Villafranchian mammal fauna was investigated by MALEZ (1975), who evaluates the latter as being typical for the Middle and Late Villafranchian. He also suggests that the fauna there should belong to the earliest Pleistocene. From the viewpoint of the current data and notions we could define the general appearance of the faunal complex as Late to Final Villafranchian, and most probably, the end of the Early Pleistocene (i.e. Post MNQ18a). This suggestion is determined by the presence of such forms as *Canis etruscus*, *Oryctolagus*, *Leptobos* and "*Dama*" *nestii*. The species

determination of *Leptobos* as *L. "stenometopon"*, i.e. *L. elatus* should be revised because of the modern conception of this genus taxonomy, as far as this form is relatively early and does not correspond to the Final Villafranchian appearance of the locality as a whole. Judging from the frequent appearance of *E. stenonis* and *Leptobos* on the one hand, and of *Sus strozzi*, *Ursus* and *Cervidae* on the other, the existence of a forest-steppe landscape and a moderate, relatively mild climate could be supposed (with existence of *Macaca*, *Oryctolagus*, "*Dama "**nestii*, *Francolinus*).

Similar to Dealui Mijlociu in Romania, the locality of Sandalja draws the attention with the remains of very ancient *Homo* - one incisor and a rather primitive stone tool of the "chopper" type. Due to that, the precision of that locality's dating is of a special significance.

A certain problem by the site dating is caused by the remains of the *Ursus* genus there. On the one hand, the simultaneous existence of three species - *U. etruscus*, "*U. mediterraneus*" (i.e. *U. gr. minimus - tibetanus*) and *U. cf. deningeri* - is dubious. The latter form (determined after one tooth fragment), on the other hand, is a species appearing not earlier than the very Beginning of Middle Pleistocene (ca. one million years ago - see in MAZZA & RUSTIONI, 1994). An infiltration of later material in a locality of Villafranchian fossils could be supposed, but there are no proofs at all for such an assumption at the moment, all the more that the fauna there appears (with the exception of *U. cf. deningeri*) homogeneous and of same age. Having in mind the insufficiency of this find, a certain subjectivity in its determination cannot be excluded (note also the uncertain determination - *U. "cf. deningeri"*).

Nevertheless, the discussed taxonomic situation concerning the *Ursus* Genus, gives reason for a motivated suggestion from the point of view of the newest taxonomic analyses. The discovery of bear remains allowing the differentiation of the three forms cited above resembles the situation of Vallonet, France (age 0.98-0.91 Ma.), and that of Pirro (Italy), with a probable age more than one Ma. (included in the Farnetta unit, after TORRE et al., 1992 or in the new "Pirro" unit after GLIOZZI et al., 1997). The bears from Vallonet show, after MAZZA & RUSTIONI (1994), mixed features of both *U. denningeri* and *U. arctos* (s. lato). These authors, at the same time, quote the fact that other researchers see there a presence also of *U. etruscus* - a species which should have disappeared earlier. The bear in Vallonet in fact shows a transitive state of evolution. The bear remains in Pirro also show some similarity with *U. etruscus*, but also a greater similarity with *U. arctos* (s. lato) (MAZZA & RUSTIONI, 1994). The distinction of "three" different forms in Sandalja I could quite probably be an indication of a similar stage of evolution. This circumstance, considered in the context of the faunal complex as a whole, makes possible to give this Croatian locality a likely age of approx. 1.2-1.0 Ma, and more exactly, somewhat more than one million years cf. Pirro unit (sensu GLIOZZI et al., 1997).

Greece:

A considerable number of localities of Villafranchian age have recently become known in Greece. Here we shall discuss some of the main localities from the Greek part of Macedonia (N-Greece), which are directly connected with the question about the Varshets and the Slivnitsa age, or are especially well known and discussed.

DAFNERO-1. The first report about this locality was recently published by KOUFOS et al. (1991). In this preliminary description the authors estimate its age as Middle-Late Villafranchian. Later Koufos and Kostopoulos specified the status of Dafnero-1 in a number of papers (KOUFOS, 1993; KOUFOS & KOSTOPOULOS, 1993; 1997; KOSTOPOULOS & KOUFOS 1994; KOSTOPOULOS, 1996). They placed it in the MNQ17 zone (= St.-Vallier unit) on the base of the similarity of the carnivores and, above all, of the horse and some Artiodactyla from the Greek locality with those from La Puebla, St.-Vallier and some other localities from that zone.

The giraffe *Mitilanotherium* (= *Macedonitherium*) known from Greece, Romania, Turkey and Tadjikistan, is one of the interesting faunal peculiarities of that Greek locality. Greece and Romania are so far the only European countries whose fauna contains with certainty giraffes from such a late time - the Villafranchian. Evidently, by the end of Pliocene those forms were typical for SE-Europe as an Asian element, because of the strongly thinned forestal vegetation of the "Tree-Savanna" type. RADULESCO & SAMSON (1990) see a great similarity and even a probable identity between the *Mitilanotherium* described from Romania, and the *Macedonitherium* from Greece. That opinion was confirmed by KOSTOPOULOS (1996), who considers *Macedonitherium* a junior synonym of *Mitilanotherium*. In Asia the Genus is known from the Middle Villafranchian of Guliazi and Kuruksay (KOSTOPOULOS, 1996). The Romanian *Mitilanotherium* inexpectatum seemingly occurs in the time, defined by the zones MNQ18 and 19, as noted above. It is possible however, that *Mitilanotherium martini* from Greece is earlier, existing in the End of MNQ17 and probably surviving up to the MNQ18 (in Libakos, Greece, it is found together with *Canis*; KOUFOS & KOSTOPOULOS, 1993). It should also be noted that *Nyctereutes megamastoides* from Dafnero-1 is quite different from the Varshets one. At the same time, it differs also from the form known from St.-Vallier and La Puebla de Valverde - much more omnivorous, i.e. more evolved regarding the main tendency for that genus. If the form from Greece and that from France/Spain lived simultaneously, then what we are dealing with here are clear geographic (subspecific) differences in the dimensions and the frequency of appearance of the different teeth morphotypes.

Having in mind those features of the Dafnero-1 fauna we could place it somewhat later than Varshets, i.e. in the second half (the end?) of the MNQ17 zone, which actually confirms the pinion of the Greek researchers.

VOLAKS (VOLAKAS). The locality was described as early as the 60s as an Early Pleistocene (Villafranchian) one (SICKENBERG, 1968) and is broadly known now. The species mentioned by different authors are typical for the Middle and the first part of the Late Villafranchian (MNQ17-MNQ18): *Vulpes* sp., *Nyctereutes megamastoides*, *Megantereon megantereon*, *Lynx issiodorensis*, *Mitilanotherium martinii*, *Eucladoceros senezensis*, "*Cervus*" *philisi*, *Croizetoceros ramosus*, cf. ? *Leptobos*, *Gazellospira* cf. *torticornis*, *Gallogoral meneghinii sickenbergii*, *Gazella* sp., *Equus stenorhis* aff. *vireti* (in our opinion, the upper premolar -P4 described by Sickenberg as a "new" ursid - *Bosdagius felinus*, is most probably a hyaena milk-tooth). Although quite rich in forms, the fauna of Volaks does not contain that many significant species to characterize more precise biostratigraphic boundaries and to determine exactly the fauna's age as Middle or Late Villafranchian. KOUFOS & KOSTOPOULOS (1993) consider that fauna as Mid/Late Villafranchian one. In the later papers of these authors (KOSTOPOULOS & KOUFOS, 1994; KOSTOPOULOS, 1996; KOSTOPOULOS, 1997; KOUFOS & VLACHOU, 1998), the age is more precisely determined, although with some hesitation - Middle Villafranchian (MNQ17). These authors' reasons for such a conclusion are:

1. The artiodactyls from the two above-mentioned localities are rather similar. This statement also concerns the association *Mitilanotherium-Gallogoral-Nyctereutes*, existing in Dafnero too (i.e. in the Middle Villafranchian), but yet unknown from the Late Villafranchian of Greece;

2. The horse from Volaks appears to be similar to that from Dafnero.

All the cited arguments of the Greek researchers seem logical and acceptable. We could also try to specify the biostratigraphic state of the Volaks locality, noting some more of its faunistic features:

1. It is quite possible that *Gazella* sp. from Volaks is identical with *G. bouvrinae* described from Gerakarou (KOSTOPOULOS, 1996; KOSTOPOULOS & ATHANASSIOU, 1997; KOSTOPOULOS, 1997)(see below the biostratigraphy of that locality). It seems *G. bouvrinae* occurred MNQ17 but also MNQ18.

2. *Mitilanotherium* of SE-Europe is connected with the second half of MNQ17 and with MNQ18-19 (as already noted).

Those circumstances, although unable to determine more emphatically the chronological position of that locality, are nevertheless an indication that it represents a Middle Villafranchian fauna of a transitive, quite late type. Similarly to La Puebla, the locality could be placed at the MNQ17-MNQ18 boundary or immediately before it (Fig. 2).

GERAKAROU (GERAKAROU 1). The macromammal fauna of the locality is rich. The new species *Parastrepsiceros koufosi* (KOSTOPOULOS, 1998) described there is a quite interesting and as it seems relict form. (It would be interesting to investigate the affinities of that form to the E-European-Asian *Caproryx*). The placing of this locality before Seneze (MADE VAN der, 1996) does not seem to

correspond to the facts. KOSTOPOULOS & KOUFOS (1994) point out that in the typical for the Middle-Late Villafranchian fauna of Europe *Eucladoceros-Cervus-Croizetocerus* association existing in the locality, the first and the last forms seem to be more evolved than the corresponding ones from Seneze. These authors suggest for the locality an age similar to that of Seneze or between Seneze and Olivola -the last opinion seems to be quite acceptable.

Somewhat later KOSTOPOULOS (1996) studied in details the artiodactyls from the locality, finding a similarity between *Eucladoceros senezensis* and its subspecific form from Seneze, and also between the *Leptobos* from Gerakarou and the forms known from Seneze and from the Early Pleistocene of Italy. This author confirms the statement made above that Gerakarou is situated in the late MNQ18: sensu KOSTOPOULOS (1996) this is the time between Seneze and Olivola. This biostratigraphic state is underlined once again in the latest paper of KOUFOS & KOSTOPOULOS (1997).

There are reasons for a further support of this thesis on the base of the data from Slivnitsa and the biostratigraphic statements already expressed in the present work:

1. The carnivores from Gerakarou show a great similarity to those from Slivnitsa (i.e. to the C. St. Giacomo Unit level): Two species of *Canis* (as probably in Slivnitsa?) - *Canis etruscus*, *C. arnensis* and also *Panthera gombaszogensis* are presented in the Greek locality (KOUFOS, 1987; 1992; KOUFOS et al., 1995). It was already mentioned above that this carnivore association is being connected with the time of the migrations from the East towards Europe typical for the Plio-Pleistocene boundary. Thus, this is an association typical for the Pleistocene beginning and the Early Pleistocene, which was considered so far not earlier than the Olivola unit. A statement was proposed in this paper that in the Mediterranean (especially the eastern ?) of Europe this group of species enters as early as the C. St. Giacomo unit (incl. Slivnitsa) (see above). Broadly accepted is the opinion that *C. arnensis* (presented in Gerakarou together with *C. etruscus*) appears in Europe later (in the Tasso unit) than *C. etruscus*. Maybe this does not correspond to the reality because *C. "senezensis"* from Seneze seems to be identical with *C. arnensis* (see SPASSOV, 1998). We have to note that in Slivnitsa (where fragmentary remains of *C. etruscus* are presented) there are also single finds dimensionally resembling *C. arnensis*. However, the *Pachycrocuta brevirostris* occurring in Gerakarou is absent in Slivnitsa which could turn to be one of the main differences here, bearing in mind that this species is a marker of the Olivola unit (i.e. of the boundary MNQ18-a/MNQ18-b: in Europe see Fig. 1-2).

2. The horse from Gerakarou and that from Slivnitsa show a number of common features. Anyway, the two populations are not identical and it seems that this similarity is not a result of a very close phylogenetic relationship, but rather of a similar level of development; it suggests a probable relative proximity in chronological aspect.

3. The two localities are similar also in the great abundance of *Bovidae*, what in fact is typical for the time after St.-Vallier unit. The taxonomic composition of the

bovid fauna and of the artiodactyls as a whole is on the other hand quite different (see in Gerakarou - *Leptobos* cf. *etruscus*, *Leptobos* sp., *Gazella bouvrinae*, *Parastrepsiceross koufosi*, and also *Sus strozzi*: KOSTOPOULOS, 1996; 1998).

Having in mind all these faunistic peculiarities and especially the presence of *Pachycrocuta brevirostris* in Gerakarou we could suggest that the age of this locality is somewhat later than the age of Slivnitsa - probably corresponding to the boundary between Costa St. Giacomo unit and Olivola unit. After our MNQ zones definition the Greek locality of Gerakarou could be placed just in the beginning of MNQ18-b (before Olivola), or on the MNQ18-a2-MNQ18-b boundary (Fig. 2).

APOLLONIA 1. This locality deserves a special interest from the aspect of the study and characterization of the Final-Villafranchian faunas (the End of Early Pleistocene) and the boundary with the Middle Pleistocene ones. The locality is of a special interest also because of its zoogeographic position - in a zone of migrations from the East. The very rich and specific fauna of the locality and its biostratigraphic status are an object of analysis in the last years. Especially characteristic and indicative forms are *Canis apollonensis* Koufos & Kostopoulos, 1997, *Meles dimitrius*, "*Baranogale* cf. *helbingi*", *Megantereon megantereon*, *Bison* (*Eobison*) sp., *Praeovibos* sp., *Pontoceros ambiguus mediterraneus* KOSTOPOULOS, 1996, *Soergelia brigittae* KOSTOPOULOS, 1996, *Caprinae* gen. sp. indet. - most probably migrants from Asia. (The *Caprinae* indet have elongated limb bones and *Ovis*-like phallangs and it is possibly an *Ovis* species (?) - person. observations in the Coll. Of the Univ. of Thessaloniki). This fauna is considered as representative for the latest Villafranchian in SE-Europe, probably similar in age to Venta Micena (Spain), as well as to Farneta (Italy), and also corresponding to the MNQ20 zone (KOUFOS & KOSTOPOULOS, 1994; 1997; 1997a; KOUFOS et al., 1995; KOSTOPOULOS, 1996; KOSTOPOULOS, in print). (It should also be noted that here is meant the classic concept of Farneta Unit's position: see TORRE et al., 1992; after this concept Pirro is included in the Farneta Unit. In the new paper by GLIOZZI et al. (1997) Pirro is considered a separate, later unit).

In Apollonia's fauna, some of the earliest finds of several genera in Europe are discovered - as especially *Bison* (*Eobison*) sp., and also relict populations from some genera like *Megantereon* for example. The latter genus is considered to have already disappeared in the central parts of the continent in the very beginning of Pleistocene (WOLSAN, 1993). In the Early Pleistocene this genus is obviously rare in Europe, and only in the Mediterranean it survives until the end of the Early Pleistocene. It seems the latest finds are known from Cueva Victoria (Spain), Farneta to Pirro Unit and, obviously, Apollonia (TURNER, 1992; KOUFOS et al., 1995; GLIOZZI et al., 1997). Typical local forms in Apollonia are the characteristic and very large "*Baranogale*" and the new species *Canis apollonensis*. Especially interesting is the discovering of forms, typical for the North and the East Pontic region (e.g. *Pontoceros ambiguus*), suggesting most probably an Asia Minor

influence. This bovid was described after materials from the Early/Middle Pleistocene deposits (layers with Late Odessian - Psecupian, Tamanian and Tiraspolian types of faunas) from the North Pontic region and Georgia (VERESHCHAGIN et al., 1971). It seems this form had its maximal distribution in the Late Apsheron - the Tamanian complex (ALEKSEEVA, 1984), which should probably correspond to the Farneta unit (in its classic definition) or to the Pirro Unit sensu GLIOZZI et al. (1997). This is the exact period when the invasion of *Pontoceros* on the Balkans should be expected - as is the case with Apollonia.

The coexistence of *Bison* and *Megantereon* shows that the remains of the mentioned artiodactyls are quite early. This is an indication that the time of Apollonia is restricted in rather narrow limits, and earlier than Jaramillo. This circumstance shows once again the similarity to Farneta Unit (in its classic definition - nota mea), which is stressed by the above-cited Greek authors; or with the Pirro Unit sensu GLIOZZI et al. (1997): In Pirro Unit were found the earliest certain *Bison* (*Eobison*) and the last *Megantereon megantereon* remains (GLIOZZI et al., 1997) in Europe.

As for Venta Micena, the age similarity is more controversial in spite of faunal resemblance. The Spanish locality represents a number of specific faunistic elements maybe connected with the isolated geographic position. The "*Capra*" of that locality is a *Hemitragus* in fact, a genus appearing in Europe earlier than *Capra*, and the form determined as *Bison* needs some additional taxonomical investigation (E. Cregut, M.H.N. - Avignon, pers. communication). Indeed, V. Micena is usually placed on the level of the Farneta unit, but the *Equus granatensis* described from there suggests a probably earlier period of time (EISENMANN, 1955).

As for the MNQ20 zone where Apollonia is situated, GUERIN (1982) places the zone in the beginning of the Middle Pleistocene and in the time after 1 Ma. This determination and the more recent data defining the phenomena typical for Farneta unit (the earliest *Megaceros* in Europe for example), contain a contradiction. A revision is needed of the notions about the time and the limits of the zone which should be placed in the beginning of Middle Pleistocene in connection with the new data. Also needed is a synchronization of the two biochronologic systems (Units and MNQ-zones) after the faunistic associations at the Early/Middle Pleistocene boundary. We could assume that Apollonia is situated in the MNQ20 only if placing that zone (or its beginning at least) before the beginning of the Middle Pleistocene - i.e. in the final Villafranchian faunal associations. In the second part - the end of this MNQ zone we could place the so-called transitive Villafranchian-Gallerian faunal associations (Vallonet) (Fig. 2).

Putting aside the complicated problem of the place of the MNQ20 zone, we could accept the following statement: Apollonia indeed represents the latest European Villafranchian associations, which demonstrate the connection between the East European and the Asian fauna. This locality could be referred

to the end of Farneta unit or above all to Pirro Unit (sensu GLIOZZI et al., 1997): an age similar to or somewhat earlier than the age of Sandalja 1 (Fig. 2).

III. Paleozoogeography and migrations

III. 1. Migratory waves from Asia to Europe in the Late Pliocene after the Varshets and Slivnitsa data

The faunas of Varshets and Slivnitsa, as well as of some other localities on the Balkan Peninsula (e.g. Gerakarou, Apollonia) bring marks of evident similarity with the Mediterranean (S-European) localities of that time, showing at the same time faunal elements obviously related to migrations from the East into Europe (see the Chapter "Palaeozoogeographical features"). The specific geographic position of Bulgaria (and the Balkans in general) are the reason of finding there all the signs of a transitive zone for the migrations of plant and animal species and humans as well. Evidence of the role of those lands as a bridge of spreading (mostly from the East to the West) exists since most ancient geological times. The regions of the Balkans and Asia Minor have played the role of a terrestrial communication more than once, thus enabling the exchange of species between Europe, Asia and Africa.

As we have already seen, the data of appearance and distribution of certain species have most often been connected with the limits of different biochronological units. Such dispersals are biotic events most often marking evident changes of the environment.

The locality of Varshets and the migrants from Asia

Two facts concerning the locality's fauna are of a special interest from the aspect of the dispersal of species from the East:

1. The discovery of *Nyctereutes cf. tingi* - a species probably of Central Asian origin; 2. The earliest finds of *Megalovis*, which origin is probably connected with the Central Asian plateaus.

The partial spreading of these species in Europe (this might also concern the new very small species of *Baranogale*) is connected with the Asian influence on that fauna (see also the Chapter "Palaeozoogeographical features of the fauna").

The find of the rather scanty and enigmatic fossil we have determined as *Gazellospira* sp. - a metatarsus from Varshets and another in the probably earlier locality of Roccaneyra (SPASSOV & CREGUT-BONNOURE, 1999) could also be connected with migrations along the Mediterranean in the beginning of the Middle Villafranchian. The clarification of this problem needs more complete finds.

The Slivnitsa locality and the early migration of *Canis*, *Panthera* and some bovids

It was already mentioned that some faunistic phenomena considered to be typical for the beginning of Pleistocene (mass migrations toward Europe), have started in fact (after the data from Slivnitsa and their connection with some other localities) as far back as in the End of Pliocene.

The appearance of *Canis* s.str. in Europe. The so called "Canis event" (AZZAROLI, 1983; BONIFAY, 1990; MASINI & TORRE, 1990; TURNER, 1992) is connected with the Asian invasion of coyote/wolf-like *Canis*. The earliest indications of such an invasion come from Costa S. Giacomo (and Seneze if the locality is of Pre-Olduvai age); Here is necessary to note the only something later locality of Gerakarou (KOUFOS, 1992), where two species of *Canis* exist (as probably in Slivnitsa?). The most apparent traces of the "*Canis event*" have been established somewhat later, in the time of the Olivola unit (*C. etruscus*), i.e. at the Plio-Pleistocene boundary (TORRE et al., 1992; ROOK & TORRE, 1996).

The insufficiently studied and earlier than the Late Villafranchian *Canis*-like forms from Europe are in fact recently separated from *Canis* s.str. (TEDFORD & QIU, 1996). Indeed, KURTEN & CRUSAFONT (1977) have noted the presence of a true *Canis* (*C. falconeri*) from a time earlier than the C. st. Giacomo unit - in P. de Valverde (MNQ17): one upper P3 and several other tooth fragments. MASINI & TORRE (1990), followed by ROOK (1994), however, express certain doubts about these remains belonging to *C. falconeri*. We also suppose that the remains have been wrongly determined and their taxonomical status should be reviewed. The tooth supposed to be an upper P3, could be in fact determined as a lower P4 after the following features: strongly enlarged hind part of the tooth, and presence of a facette of occlusion on the linguo-distal surface of the tooth's crown base.

It should also be noted that the stratigraphic position of this find from Costa S. Giacomo is not absolutely sure (earlier than Olivola Unit ?), so that it might turn to be not earlier than Olivola.

Having in mind the stratigraphical problems on the age of the *Canis* find from Costa S. Giacomo and Seneze we can appreciate the discovery of *Canis* ex gr. *etruscus* in Slivnitsa as a fact of considerable importance SPASSOV (1998). This locality proposes, most probably, the earliest registration in Europe of the Late Villafranchian "*Canis event*". It, at the same time, appears to confirm the Late Pliocene and not Early Pleistocene age of the penetration of the first wolf-like primitive forms in Europe from the East. On the basis of the material from Slivnitsa, Seneze, C. S. Giacomo and Gerakarou we can suggest that statement as valid for South Europe at least. (In the fauna of the Hapry Complex - near the Sea of Azov with a supposed age the beginning of MNQ17, *Canis etruscus* - *arnensis* was also announced recently (SOTNIKOVA et al., 1998). As already mentioned above, this could be resulted from the existence of younger layers besides the direct contact with Asia.)

The *Panthera* invasion. In Slivnitsa we note the earliest presence of *Panthera gombaszoegensis* and thus of *Panthera* s.str. as a whole (SPASSOV, 1997a; 1998). *P. gombaszoegensis* has been recorded in Tegelen (2,2-1,7 Ma), but it originates from the uppermost levels there (TURNER, 1992). The earliest true finds of this predator so far seem to be the ones from Gerakarou, Greece (KOUFOS, 1992; KOUFOS et al., 1995) and Olivola, Italy (the Plio-Pleistocene boundary) (TORRE et al., 1992; TURNER, 1992)). The Gerakarou locality should be dated from the Seneze-Olivola units boundary (see above).

The early mass bovidae migrations. The progress of a number of bovids and their invasion from Asia into East Europe and over the whole continent started during the Villafranchian, with the increase of the aridification. Two unknown bovids (not determined up to genus and species) and an *Ovis* sp. are established in Slivnitsa. The two *Bovidae* spp. (indet.) seem to have no analogue in the other European faunas known so far and, together with the first indication of "*Ovis*" in Europe mentioned above, could be considered as a testimony of the process of enlarging the areas of Asian species at that time. It was already mentioned that an enigmatic skull of a large *Ovis* sp. has been determined by Schaub from Seneze and this could be used as another argument of the same dispersal. A strong influence on the migrations from East of the Villafranchian fauna of bovids in Greece is noted by KOSTOPOULOS (1996). It is obvious in the Final Villafranchian locality of Apollonia. In the Greek locality of Gerakarou, which is slightly earlier than Slivnitsa, there too appear some bovids with a taxonomy not clear enough, such as the enigmatic *Parastrepsiceros koufosi* (KOSTOPOULOS, 1998). (These forms can, most probably, be considered elements from a more Eastern, untypical for W-Europe fauna, expanding its area during the aridification in the SCT10 of ZUBAKOV & BORZENKOVA (1990)). There is no doubt that a more detailed comparison of the so far taxonomically undetermined forms from Slivnitsa and Gerakarou should be of great value.

Climate and migrations. There is some data that in the time corresponding to the Meria cooling (Fig. 1) some Anatolian coastal islands were connected with Asia and that the Black Sea waters were freshened (ZUBAKOV & BORZENKOVA, 1990; DERMITZAKIS, 1990). This suggests a temporary closing of the Bosphorus. The following faunal contact with Asia Minor proposes an explanation of the presence in Slivnitsa of remains of most early migrants (between 2 - 1,9 Ma.) from the East, e.g. *Canis* s.str., *P. gombaszoegensis* and a number of *Caprinae*. By the Balkan migratory way they quickly spread in Europe (mainly in the Mediterranean area, where climate and landscapes are similar - Olivola, Seneze).

After removing geographical barriers (e.g. the Bosphorus), the migratory waves usually spread instantly from a geological point of view when the new territories grant the same natural conditions as those native for the migrants. Apparently the rate of the mentioned migrations was in Europe high enough after the age of all the Eastern and the Western finds of the earliest migrants. The local

conditions, however, could somewhat slow down the tempo of penetration. For instance, the find of *P. gombaszoegensis* in Slivnitsa makes us suppose that some migratory events from the East could possibly be registered in Eastern or SE-Europe somewhat earlier than in the Western or the Central parts of the continent (SPASSOV, 1997a; BOEUF et al., 1997).

III. 2. Palaeozoogeographic characters of the Middle and Late Villafranchian fauna of S.-E. Europe on the examples of Varshets and Slivnitsa

A number of indexes have been created for an easier comparison of the differences and the similarities between the faunas. Useful when comparing fossil mammal faunas from different localities are, for example, E. Simpson's index of resemblance and M. Pickford's index of faunistic distance (when the number of species and individuals/number of bones is great enough (De BONIS et al., 1994)). When determining the appearance of faunas relatively late in geological aspect, such as the Villafranchian ones, the comparison of the geographical affinities of relatively close localities is not so important because they are often evident: The distribution, the origin of species and the natural environment typical for them, are more clear. In this case (similar to the modern faunas) the comparison of entire regions with each other is rather important. Moreover, in such a case it is not enough to search for generic similarities when looking for affinities and differences in such faunas, but the necessity of comparisons on specific, or even subspecific level becomes even more obvious. This, on its turn, makes the use of zoogeographic boundaries and indexes somewhat risky. The determination of the fossil faunas on a level lower than generic is often quite uncertain; data about the distribution of different forms is still insufficient; in such circumstances the affinities between the faunas from different localities could be a result of taphonomic and ecologic, rather than zoogeographic reasons. Of importance in these cases is the determination of the fauna's general appearance after the influence and presence of the concrete species, as far as their distribution areas and origin could be defined at all.

The available data on the distribution of the different taxa, as well as on their adaptive abilities, makes possible to determine more or less their areas of distribution and in a number of cases to suggest their centres of origin as well. Such analyses applied to the species from Varshets and Slivnitsa are useful for the characterization of the zoogeographic appearance of the faunas present in those two localities (Fig. 3-4).

Summarizing the ideas presented in fig 3-4, we could divide the taxa in several groups after their distribution. Those groups make possible a zoogeographic analysis of the Varshets and Slivnitsa faunas. At the same time these groups, as

far as they concern a great number of typical Villafranchian species give information about the zoogeographic relations between the faunas of different regions of Europe and the adjacent territories. They reflect the climatic zones, environment and geographical centres of origin of that time. The taxa from the localities could be divided (some of them not without hesitation, due to the uncertain determination) in the following groups after their distribution:

1. Middle/East European and European (in general) species (it is quite probable many of them are Eurasian forms). Species of that type of distribution are probably adapted to some more "boreal" conditions compared to the typically Mediterranean species, in spite of the fact that the conditions in the Late Pliocene do not seem to show such an expressed zonality as it is in the present days.

2. Eurasian species, distributed mainly in the area known today as Palaearctics (incl. N-Africa). It should be noted that here prevail species, which seem to be typical by this time for the more southern parts of that territory.

3. Species of S-European (Mediterranean) - Fore/Central Asian type of distribution. Species of Circumpontical distribution are also placed here. It is possible indeed future investigations will show that some of these species might be only S-European (Mediterranean endemics) and should not be allied to the Foreasian ones. (A pure European distribution is possible also for some of the species considered here as "Eurasian"). Nevertheless, this is scarcely possible for most of them, bearing in mind the mobility of big mammals. It seems that a number of them are species which have penetrated from the more or less arid areas of Central and Fore Asia into similar landscapes of the N-Pontic region, the Balkans and the European part of the Mediterranean.

Depending on their adaptation to the climatic conditions and, above all, to the humidity, a number of species from Central Asia penetrated also in later times, during the whole Quaternary in certain regions of Europe, using one of the two (sometimes maybe both ?) migratory roads:

- a). The road along the Northern Pontic region (mainly steppe species, resistant to harsher conditions), leading mainly to Eastern-Central Europe.

- b). Asia Minor-Balkan road (during a closing of the Bosphorus) mainly to the European part of the Mediterranean. It seems that in both cases the Balkans have been influenced by such penetrations.

4. Asian elements (Migrants). Here are concerned species which have reached Europe at some level of their expansion, becoming European species, too. The concept "Asian migrants" could be used here to indicate those species, which are met for a first or nearly first time on the continent in localities like Varshets and Slivnitsa (on the "front line" in Europe) (see also the Chapter: Migratory waves toward Europe in the End of Pliocene).

5. New species: Of course, this is not a zoogeographic category and it is used here quite free, as far as we could only suppose and not decide for sure what these species are after their origin or at least after their distribution.

No. of zoogeographic group after taxa distribution (see the text)	Taxa	Distribution after current data
3	<i>Vulpes alopecoides</i>	The European Mediterranean; South Europe
4	<i>Nyctereutes cf. tingi</i>	Central Asia - asian element
2	<i>Ursus minimus - etruscus</i>	Eurasia
1	<i>Martes wenzensis</i> - <i>Martes vetus</i>	Central Europe (Europe as a whole)
3	<i>Pannonictis ardea</i>	Europe; Fore Asia; Transcaucasia
1	<i>Vormela petenyii</i>	central and East Europe
5	<i>Baranogale</i> nov. sp.	The Balkan Peninsula
3	<i>Meles thoralis</i>	South Europe; Fore Asia; Transcaucasia
2	<i>Pliocrocota perrieri</i>	Europe; Central Asia; North Africa
2	<i>Lynx issiodorensis</i> <i>issiodorensis</i>	Europe; Asia; ?Africa
3	aff. <i>Viretailurus shaubi</i>	Western Europe; The European Mediterranean
2	<i>Acinonyx pardinensis</i>	South Europe; Central Asia
3	cf. <i>Cervus philisi</i>	Southern and Western Europe
2	Cervidae gen.	Southern and Eastern Europe; ?Asia
1	<i>Eucladoceros senezensis</i> cf. <i>vireti</i>	Southern (Western?) Europe (Europe as a whole?)
3	<i>Gazellospira</i> sp.	Southern Europe
4	<i>Megalovis</i> aff. <i>latifrons</i>	(Europe, Asia) - asian element
3	<i>Equus stenonis</i> cf. <i>vireti</i>	Southern (and Eastern?) Europe

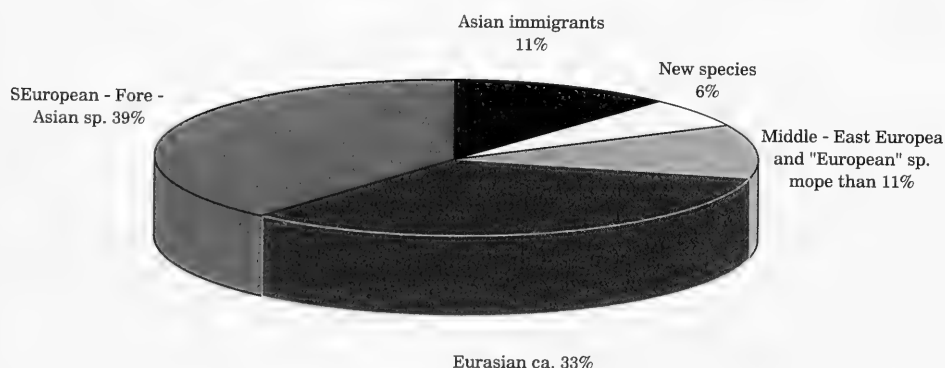


Fig. 3. Geographic area of distribution of the taxa from Varshets

VARSHETS (Fig. 3). Unlike most of the well known Mediterranean faunas, that of Varshets shows a connection with the faunal associations of Middle- and E-Europe; examples supporting that suggestion are forms as *Vormela* (*Pliovormela*) *petenyii* and *Martes wenzensis* - *vetus*; *Martes* sp. has been found in Italy (see De GIULI et al., 1990) but this genus seems to be rare in the South and the specific belonging still remains unclear). However, the appearance of the fauna of Varshets shows greatest similarity to that of the European-Mediterranean localities. The relationship to Fore Asia is evidently strong, too. In spite of some hindering relativity by the determination of some species, a tendency of prevalence emerges of taxa with S-European and Fore Asian distribution. This, in fact, appears to be quite logical bearing in mind the geographical position of the locality and the clear indications of an influence of Asian elements.

SLIVNITSA (Fig. 4). In its main zoogeographic affinities, the fauna of Slivnitsa follows the same patterns as the earlier fauna of Varshets does. The S-European and Foreasian forms, together with the influence of the first waves of migrants from Asia (see below), are playing an especially important role in creating the general appearance of the faunal complex of the locality. After the fauna of the Slivnitsa locality we could trace the migratory route of the first immigrants from the East, such as *Canis* and *Panthera*, which some later - in the Beginning of Pleistocene - become an important element of the general appearance of the European fauna.

The strong Asian influence on the Balkan fauna could be traced also by the presence of other forms, as *Ovis* sp. and some unidentified bovids, most likely migrants from the East. The data on the Late Villafranchian fauna of Greece and Romania also confirms the strong influence of faunal elements formed most probably in the Fore/Central Asian and East European open spaces; the presence of such genera as *Mitilanotherium*, *Parastrepsiceros*, *Pontoceros* (see the chapter: Biochronology of S-E Europe).

Some authors consider the Late Miocene faunas of Greece and Turkey as belonging to the same zoogeographic region - "Greek-Iranian province", spread from Macedonia to Iran, and probably Afghanistan (De BONIS et al., 1994). Perhaps it would be more correct to call that province Balkan-Iranoturanian including the Northern Pontic area. Thus it would reflect the distribution of the typical "hipparion fauna" of the East European-Foreasian open spaces, which seems to have been quite homogenous.

The distribution and "physiognomy" of the faunas in the end of Pliocene cannot, of course, be similar to those from the end of Miocene. Therefore it would be too risky to express some more concrete suggestions about the above-mentioned province in those times. However, the new wave of aridification and the new periodical appearance of a "landbridge" between Asia Minor and the

No. of zoogeographic group after taxa distribution (see the text)	Taxa	Distribution after current data
4	<i>Canis ex. gr. etruscus</i>	Asian migrant
3	<i>Vulpes cf. alopecoides</i>	European Mediterranean (S. Europe)
3	<i>Meles thoralis</i>	S. Europe, Fore Asia, Transcaucasia
2	Lutrinae gen.	Eurasia, Africa
2	Hyaenidae gen.	Eurasia (recent Palaeartic region)
4	<i>Panthera cf. gombaszoegensis</i>	Asian migrant
2	<i>Homotherium crenatidens</i>	Europe, Central Asia
3	" <i>Cervus</i> " <i>philisi</i> - " <i>Dama</i> " <i>nesti</i>	S. and E. Europe
1?	<i>Eucladocerus cf. tornicornis</i>	S. Europe (Europe as a whole?)
2	<i>Gazellospira cf. brivatense</i>	Eurasia (recent Palaeartic region)
1	<i>Procamptoceras cf. brivatense</i>	Europe
3	<i>Gallogoral menenghinii</i>	South Europe
1	<i>Pliotragus cf. ardeus</i>	Europe (as a whole?)
2	<i>Megalovis sp.</i>	Eurasia
5	<i>Hemitragus sp. nov.</i>	new species (for the moment on the Balkans)
4	<i>Ovis sp.</i>	Asian migrant
4	Bovidae gen. et. sp. indet-I	Asian/ North Pontic migrant
4	Bovidae gen. et. sp. indet-II	Asian/ North Pontic migrant
1	<i>Equus cf. stenonis</i>	Europe (the Mediterranean?)

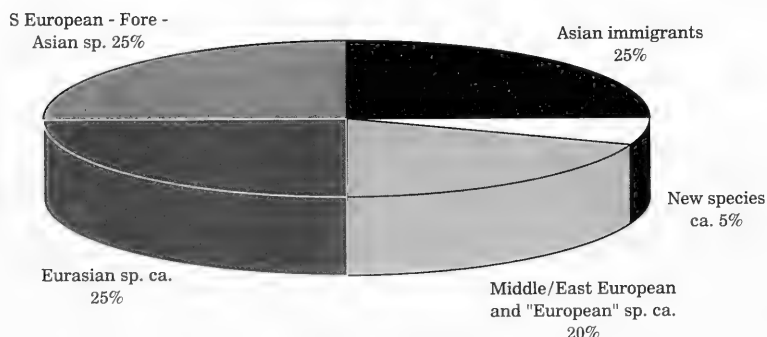


Fig. 4. Geographic area of distribution of the taxa from Slivnitsa

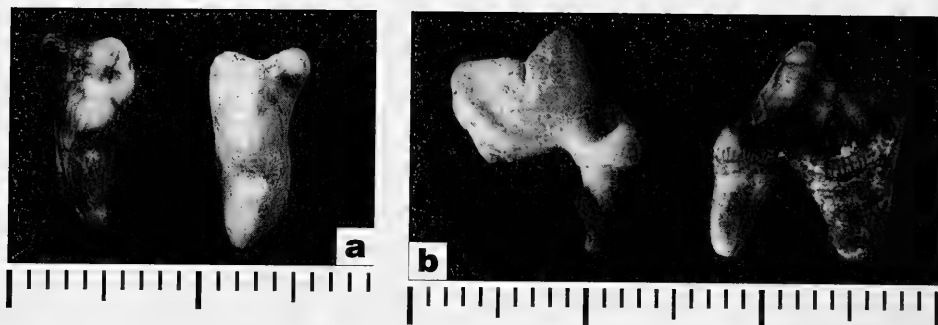


Fig.5. Right upper P4 of *Vulpes* sp. from Musselievo (second half of MNQ15 - the earliest find of the *Vulpes* genus in Europe) A: occlusal view of the tooth from Musselievo (at right) and left upper P4 of *Vulpes* cf. *alopeoides* from Slivnitsa (beginning of MNQ18) (at left); B: the same teeth - P4 from Musselievo (left) and P4 from Slivnitsa (right) - lingual view; C: the same teeth - P4 from Musselievo (right) and P4 from Slivnitsa (left) - labial view.



Balkans result in the preserving or repeated creation of a number of similarities and connections between the faunas of the above-mentioned regions (see below). At the same time, just like recently - in the forming of the Late Pleistocene and Holocene faunas of the Balkans and Europe, the Asia Minor-Balkan and the North Pontic routes are playing an important role for the penetration of Asian elements in Europe. They reach the Balkans usually via one or the other of the two routes and could penetrate to the West looking for suitable conditions, similar to those they have been formed in.

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Author's address:

Nikolai Spassov

National Museum of Natural History

1, Tsar Osvoboditel Blvd

1000 Sofia, Bulgaria

e-mail: wild_fund@mbox.cit.bg

Биохронология и зоогеографски афинитети на вилафранкската фауна от България и Южна Европа

Николай СПАСОВ

(Резюме)

Първият побей на смяната на русчинската с вилафранкская фауна и на активното наблизане на степни елементи може да бъде отбелязан на Балканите с находището Муселиево (втора половина на зона MNQ15). Новите богати български находища Вършец (St. Vallier unit) и Сливница (Costa St. Giacomo unit) представят сукцесия на късноплиоценски фауни и дават основание за сравняване и анализ на основните вилафранкски находища от Югоизточна Европа. Такива са например Valea Roscai, La Pietris, Valea Graunceanului, Fintinalui Mitilan (Румъния), Sandalja-1 (Хърватска), Dafnero-1, Volaks, Gerakarou, Apollonia (Гърция). Същевременно тези находища съвпадат с времето на важни миграционни процеси от изток към Европа и показват първите наблизания на отделни фаунистични елементи в сухоземната фауна на континента. Тези миграции са следствие на климатичните промени в началото на средния вилафранк и по време на захлаждането Мерин (= SCT10 на Zubakov & Borzenkova). Разпространението на редица видове на запад, особено в Средиземноморската зона е било много бързо поради наличие на подходящи условия. Началото на късния вилафранк в Европа би трябвало да съвпада с климатозоната SCT10, със C. St. Giacomo Unit и със зона MNQ18. Същевременно тази зона трябва да бъде дефинирана наново. Тя може да бъде подразделена на MNQ18-a1; MNQ18-a2 (= C. St. Giacomo Unit) и MNQ18-b (= Olivola Unit). Използването на биохронологичните критерии разработени за западноевропейския вилафранк могат да бъдат прилагани в Източна и Югоизточна Европа, но като се държи сметка за съществуването на реликтни и локални фауни, както и за азиатското влияние там. В богатите фауни от Вършец и Сливница доминират южноевропейско-предноазиатските видове. Това говори вероятно за съществуване на медитеранско-южноевропейско разпространение на редица видове едри бозайници, както и за силното влияние на азиатската фауна върху фауната на Югоизточна Европа, а може би и върху южните части на Европа като цяло.

Soil algae in museum samples from some Southwest Asia sites. I.

Maya STOYNEVA

Introduction

Soil algae attracted the attention of scientists since the first description of *Nostoc commune* Vaucher as aero-terrestrial species by DILLENIIUS (1741) till nowadays (e.g. ETTL & GÄRTNER, 1995). The floristic studies of soils began by the work of GRÄBNER (1895) and later, in 1948, FEHÉR was the first who compiled information on the geographical distributon of soil algae based on 685 identified taxa. Recently edaphic algae of nearly every biome have been studied (GRONDIN & JOHANSEN, 1995). Nevertheless, data about the soil algal flora of some regions could be classified as scarce. Such a region still is the Southwest Asia (COMPÈRE, 1981; METTING, 1981). There only several algae from the deserts of south Iran (in the region of Bandar-Abbas and Zahedan) and Syria have been reported by NOVICHKOVA-IVANOVA (1980).

Several types of research dealing with soil algae have been done. Besides the already mentioned floristic studies, taxonomic investigations on selected algal groups and studies on economically important nitrogen-fixing algae in rice fields and deserts were the most popular among them (GRONDIN & JOHANSEN, 1995). Most of these works deal with fresh soil samples. First data on long term accumulation of resting stages of surface algae which can remain viable for years have been provided by BRISTOL (1919, 1920) and after that the moisture relations of terrestrial algae were studied by FRITSCH (1922), FRITSCH & HAINES (1923) and FRAYMONT (1928). In 1941, LIPMAN was able to culture a cyanoprokaryote which has been in a dry soil in a herbarium sheet for 87 years. However, the number of such studies with samples kept in air-dry conditions for years still is relatively small (e.g., BECQUEREL, 1942; PARKER et al., 1969). HILTON & TRAINOR (1963) provided data on taxa present after desiccation for one year and subsequently TRAINOR (1970, 1985) published a list of taxa which survived both 10 and 25 years. There was reported that from 31 taxa of 17 genera in the original fresh Connecticut cornfield soil, after 10 years the number of taxa was 11 and after 25 years of desiccation this number was

7. Recently, TRAINOR & GLADYCH (1995) published data on the same soil sample 35 years after it was collected. In this paper they reported 5 survivors or 16% of original taxa in the fresh soil. It is noteworthy to mention that all the survivors were green algae from the genera *Chlamydomonas*, *Chlorella*, *Chlorococcum*, *Protosiphon* and *Tetracystis*. A research on the temperature tolerance of soil algae has been also carried out (e.g. TRAINOR, 1962, 1983, 1985) but a full review on this problem is beyond the scope of our study. As far as some of the results are relevant to the desiccation of soil samples, we will underline that according to TRAINOR (1985) the survivors which stand drastic temperature treatment again are green algae. The distribution and abundance of soil algae in relation to pH has also been studied and the general conclusion from these studies is that cyanoprokaryotes are less abundant on acidic soils than on neutral to alkaline soils (RAJU, 1972; METTING, 1981; STARKS et al., 1981). They have never been reported in soils with pH of 5 or less (BROCK, 1973). Generally, green algae are more common in soils with lower pH in comparison to blue-greens (FOGG, 1956; HOLM-HANSEN, 1968; RAJU, 1972; BROCK, 1973; KING & WARD, 1977; CARSON & BROWN, 1978; STARKS et al., 1981). In the same time, it was shown that even soils with the same pH had clearly distinct communities (ALI & SANHU, 1972). Chlorophytes were reported to be abundant in forest soils, whereas in arid and semi-arid environments cyanoprokaryotes were more common (STARKS et al., 1981).

In the present paper data about the species composition and distribution of algae in 32 localities from Southwest Asia are provided. These results have been obtained after processing of soil samples 19 years after keeping in air-dry conditions.

Material and methods

There have been analysed 32 samples collected from the surface soil layer from 32 localities in Turkey, Iraq, Iran, Syria and Lebanon during the period 30 October - 21 December 1972 (Fig. 1) by P. Beron, T. Michev and V. Beshkov. The brief description of the localities provided below follows their travel-notes. Generally, most of them are situated in arid or semi-arid areas (ABRANSON & DIXON, 1977). Due to practical reasons the localities were assigned to the following habitat types: tillable fields and other arable lands, untillable fields, steppes, semi-deserts, meadows and small forests / groups of single trees or shrubs.

After 19 years keepment in air-dry conditions the collected soils were cultivated in the media of Bristol modified by GOLLERBAKH (1936) with addition of microelements according to ALLEN & ARNON (1955). The algae have been determined on semi-permanent slides after cultivation period of 1 week, 3 weeks, 1, 2, 3 and 5 months in order to follow different stages of algal growth. Determination of algae was done according to the floras of GOLLERBAKH et al. (1953), STARMACH (1966, 1968), MATVIENKO & DOGADINA (1978), PALAMAR-MORDVINTZEVA (1982),

KOMÁREK & FOTT (1983), ETTL & GÄRTNER (1988), BOURRELLY (1990) and KORSCHIKOV (1987), to the Syllabus of ETTL & GÄRTNER (1995), as well as according to the monographs by PRINTZ (1964) and TUPA (1974). The classification system follows ETTL & GÄRTNER (1995) with some modifications by STOYNEVA (1998) and KOMÁREK & ANAGNOSTIDIS (1999). The distribution of each species was evaluated according to its frequency quotient FQ (DARNELL, 1979). The floristic similarity of the investigated sites was estimated according to the index of SÖRENSEN (1948) - SSI. The values of SSI were grouped in 7 classes: I - with SSI = 1-10%, II - with SSI = 11-20%, III - with SSI = 21-30%, IV - with SSI = 31-40%, V - with SSI = 41-50% and VI - with SSI = 51-60%.

Localities (Fig. 1):

- Loc. 1 - 30 km northern to the town of Rascht (northern Iran), untillable field at the bank of the rivulet Sefitrud, sampled on 7.11.1972;
- Loc. 2 - 35 km northern to the town of Sandjan (Iran), steppe, sampled on 6.11.1972;
- Loc. 3 - 3,500 m a.s.l. at the mountainside below the Demavend peak (Iran), soil among *Astragallus* sp., sampled on 13.11.1972;
- Loc. 4 - 258 km northern to the town of Shiraz (Iran), arable land at 1,770 m a.s.l., sampled on 21.11.1972;
- Loc. 5 - 30 km northern to the town of Shiraz (Iran), sampled on 22.11.1972;
- Loc. 6 - village of Shapur (southern Iran), near a ditch in a orange-orchard, sampled on 25.11.1972;
- Loc. 7 - near to Omidyeh (Iran), tillable field, sampled on 29.11.1972;

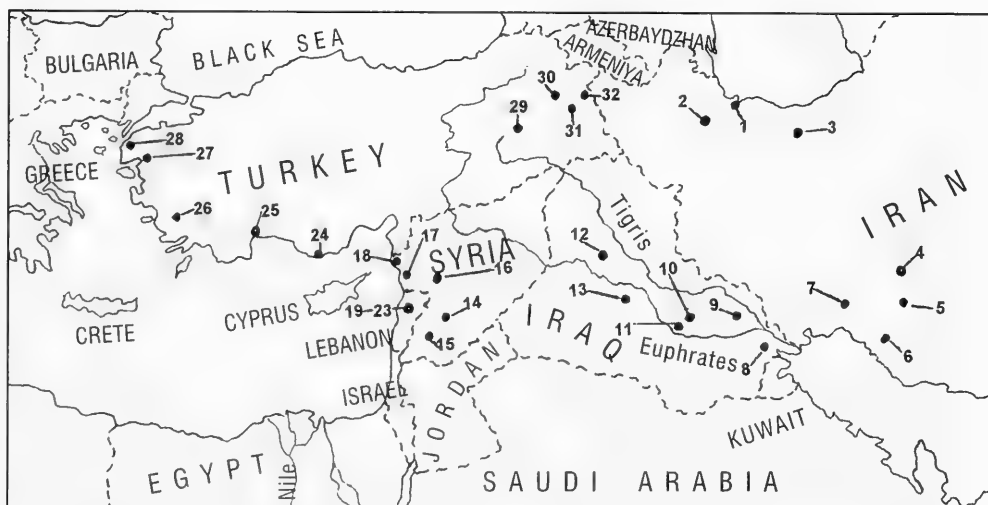


Fig. 1. Map of the Asia Minor region with the studied localities

1-32 - number of site in compliance with the number in the text

- Loc. 8 - near to the town of Qurnach (Iraq), alluvial soil from a date-forest, sampled on 30.11.1972;
- Loc. 9 - 72 km western to the town of El-Qut (Iraq), reaped wheat-field at the bank of the Tigris River, sampled on 1.12.1972;
- Loc. 10 - near the village of Algaye (Iraq), date-forest, sampled on 2.12.1972;
- Loc. 11 - Babylon-ruines (Iraq), soil near to a freshwater canal, sampled on 4.12.1972;
- Loc. 12 - Samara-reservoir (Iraq), soil from the shore, sampled on 5.12.1972;
- Loc. 13 - semi-desert near to the shore of the lake Habbaniya (Iraq), sampled on 6.12.1972;
- Loc. 14 - in the vicinity of Damascus (Syria), a cabbage-garden, sampled on 7.12.1972;
- Loc. 15 - near to the Krak des Chevaliers (Syria), arable land, sampled on 11.12.1972;
- Loc. 16 - 50 km eastern to the town of Homs (Syria), semi-desert, sampled on 11.12.1972;
- Loc. 17 - Ansariya-crest, 50 km southern to the town of Banias (Syria), soil under oaks in a karstic region, sampled on 12.12.1972;
- Loc. 18 - 10 km northern to the town of Banias (Syria), soil under a cactus, sampled on 12.12.1972;
- Loc. 19 - near to the village of Zahli (Lebanon), arable land, sampled on 8.12.1972;
- Loc. 20 - 20 km eastern to Beirut (Lebanon), meadow above 900 m a.s.l., sampled on 9.12.1972;
- Loc. 21 - near the Grotte de Jeita, 15 km north of Beirut (Lebanon), soil from star-pine and oak forest, sampled on 10.12.1972;
- Loc. 22 - place "The Cedars" (Lebanon) situated at 1,900 m a.s.l., soil from a cedar-forest, sampled on 10.12.1972;
- Loc. 23 - near to the village of Zegorta (Lebanon), olive-forest, sampled on 10.12.1972;
- Loc. 24 - 30 km eastern to the Anamur (southern Turkey), arable land near to the sea-shore, sampled on 16.12.1972;
- Loc. 25 - 56 km northern to Antalya (southern Turkey), reaped wheat-field, sampled on 17.12.1972;
- Loc. 26 - near Pamukkale (Turkey), soil from a cotton-field, sampled on 18.12.1972;
- Loc. 27 - near Bergama (western Turkey), meadow, sampled on 20.12.1972;
- Loc. 28 - near Troya (Turkey), arable land, sampled on 21.12.1972;
- Loc. 29 - 60 m to the shore of the Lake Van (Turkey), soil from a wheat-field at 1,720 m a.s.l., sampled on 3.11.1972;
- Loc. 30 - Tahir-pass (Turkey) at 2 475 m a.s.l., meadow, sampled on 30.10.1972;
- Loc. 31 - in the vicinity of the spring of the Euphrates River (Turkey), soil from a pine-forest at 1 500 m a.s.l., sampled on 31.10.1972;
- Loc. 32 - 10 km to the village of Tutak (eastern Turkey), soil from a wheat-field, sampled on 31.10.1972.

Results and discussion

In total, 114 species and 4 forms from 68 genera of 3 divisions have been determined. Their distribution and relative abundance at the localities is shown on Table 1.

Most of the species (72%) were rarely distributed and occurred in 1-3 studied sites (FQ = 3-9%). Among them the highest is the number of taxa (49 or 42%) found in one site only. 18 species were found in 4-6 sites, 7 - in 7-9 sites, 3 - in 10-12 sites and 2 - in 13-15 sites (*Microcystis pulvereae* - in 13 and *Nostoc linckia* - in 15 sites). Only one species (*Leptosira terrestris*) was found in 16 studied sites and had FQ = 50%.

The distribution of species in the studied habitats was as follows: 46% of the species occurred in one habitat type; 24% - in two habitat types; 13% - in three habitat types; 10% - in four habitat types; 4% - in five habitat types and 2% - in seven habitat types (Table 1).

The number of species per site varied from 2 (loc. 2) to 28 (loc. 9). The number of species per site in tillable fields and other arable lands ranged from 10 to 15 (with two exceptions - loc. 9 and 29 with 28 and 3 species, respectively), in untilable fields - from 8 to 12, in steppe sites - from 2 to 4, in semi-desert sites - from 7 to 9, in meadows - from 9 to 17 and in sites located in small forests or under groups of single trees or shrubs - from 3 to 21.

The values of SSI varied between 0 and 56% (Table 2). 27% of the studied sites contained quite different algal flora and did not show any similarity (SSI = 0). Most of the sites were with extremely low similarity (I and II class) - 16% and 31%, respectively. Low similarity (III and IV class) was detected between 17% and 6% of sites, respectively. Only 2% of the studied sites had SSI values of V class and only two sites (13 and 14) had SSI = 56%. The most poor in species and most peculiar were the steppe soil from the 2nd locality, the soil collected among the Babylon-ruines (loc. 11) and the wheat-field soil from the 29th locality. They contained 2, 4 and 3 species, respectively and clearly differed from the other studied sites. Low similarity with the other sites was calculated also for the soils collected from localities 3, 16, 17, 18 and 22. Poor in species composition (4-7 taxa) were the soils from localities 5, 10, 11, 16, 22 and 23. All these soils were from different habitats or were collected under different trees and shrubs (see localities above).

Cyanoprokaryotes were the most abundant species in most of the studied soils. *Nodularia harveyana* dominated in the samples from steppe sites (loc. 2, 5) and once was a sub-dominant in a soil from an arable land (loc. 15). *Cylindrospermum* was the dominant genus in semi-desert soils (loc. 13, 16). The variation in dominants there was at species level - *C. muscicola* dominated at site 13 and *C. licheniforme* dominated at site 16. *C. licheniforme* and other species of this genus occurred also mainly as co- or subdominants and more rarely as monodominants in soils collected from forests or under single trees or cacti (loc. 8, 17,

Distribution of algal species in the studied Southwest Asia sites and their relative abundance

1-32 - number of site in compliance with the number in the text; xxx - dominant or co-dominant species, xx - sub-dominant species, x - presence of the species

[illegible]

ALGAE/SITES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
<i>Leptolyngbya gracilima</i> (Zopf. ex Hansg.)																																	
Anagn. et Kom.													X			XX															X		
<i>Leptolyngbya notata</i> (Schm.)																																	
Anagn. et Kom.													X																				
<i>Lyngbya hieronomusii</i> Lemm.																																	
<i>Microcoleus delicatulus</i> G. et S. West																																	X
<i>Microcoleus sociatus</i> W. et G. S. West																																	X
<i>Microcoleus vaginatus</i> (Vauch.) Gom.																																	
<i>Microcystis incerta</i> (Lemm.) Starm.																																	X
<i>Microcystis hansgirgiana</i> (Hansg.) Elenk.																																	
<i>Microcystis pulvere</i> (Wood)																																	
Forti emend. Elenk.																																	X
<i>Nodularia harveyana</i> Thuret																																	
<i>Nodularia</i> sp.																																	
<i>Nostoc calcicola</i> Breb.																																	
<i>Nostoc commune</i> Vauch.																																	
<i>Nostoc ellipso sporum</i> Rabenh.																																	
<i>Nostoc linekia</i> (Roth) Born.et Flah.																																	
<i>Nostoc minutissimum</i> Kutz.																																	
<i>Nostoc muscorum</i> Ag.																																	
<i>Nostoc paludosum</i> Kutz.																																	
<i>Nostoc punctiforme</i> (Kutz.) Har.																																	
<i>Nostoc spongiaeforme</i> Ag.																																	
<i>Oscillatoria jantiphora</i> (Fior. Mazz.) Gom.																																	
<i>Phormidium ambiguum</i> Gom.																																	
<i>Phormidium autumnale</i> (Ag.) Gom.																																	
<i>Phormidium molle</i> (Kutz.) Gom.																																	
<i>Phormidium molle</i> (Kutz.)																																	
Gom. f. tenue (Wor.) El.																																	
<i>Phormidium papillaterminatum</i> Kissel.																																	

[illegible]

ALGAE/SITES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
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Bacillariophytina

Gomphonema sp.

x

CHLOROPHYTA

Actinochloris terrestris (Visch.) Ettl et Gartn.

x

Apatococcus constipatus (Printz) Printz

xx

Apatococcus lobatus (Chod.) J. B. Peters.

x x x x

cf. *Borodiniopsis* sp.

x

x

Bracteacoccus minor (Chod.) Petr.

x

x

Chlamydocapsa cf. *maxima* (Mainx)

x

Ettl et Gartn.

x

Chlamydomonas spp.

x x x

Chloroclonium gloeophyllum Borzi

x xx

Chloroclonium parvulum Borzi

x

Chlorococcum infusionum (Schr.) Meneghini

x

Chloroplanea terricola Hollerb.

x

Chlorosarcina sp.

x

Chlorosarcinopsis minor (Gern.) Hernd.

x

Chlorosarcinales sp. div.

x x x

x

Chlorosphaeropsis alveolata Hernd.

x

x x

Cosmarium humile (Gay) Nordst.

x

Cylindrocapsa cf. *involuta* Reinsch.

x

Cylindrocapsa sp.

xx

Desmococcus olivaceus (Pers. ex Ach.) Laund.

x

x

Dysmorphococcus cf. *coccifer* Korsch.

x

x

Folicularia sp.

x

x

Gloeocystis polydermatica (Kutz.) Hind.

x

Hormidium sp. (fragments)

x

Hormotilopsis gelatinosa Train. et Bold

x

Keriochlamys styriaca Pasch.

x

x

18, 23). *Nostoc* is the most abundantly represented genus in the studied arable lands and tillable fields (loc. 4, 6, 7, 9, 14, 15, 19, 24, 25, 26, 28, 29). In most of the tillable fields *Nostoc punctiforme* was the dominant species (loc. 24, 25, 26) whereas in the most of other arable lands (loc. 6, 14, 15, 19) *Nostoc linckia* dominated. In forest (incl. soils under single trees and shrubs) and in meadow soils more often *Nostoc commune* dominated (loc. 3, 21, 22, 27, 30). *Nostoc calcicola* dominated or co-dominated in an untillable field (loc. 1), in a tillable field (loc. 7) and in a date-forest soil (loc. 10). Representatives of genera *Stigonema*, *Scytonema*, *Scytonematopsis*, *Calothrix* and *Tolypothrix* (Table 1) more often occurred as dominants, subdominants and abundant species in meadow soils (loc. 20, 30) and untillable fields (loc. 1, 32) than in arable lands (loc. 15). *Phormidium ambiquum* dominated in the soil from an untillable field (loc. 32). Various representatives of *Anabaena* and mainly *A. oscillarioides* and its forms *minor* and *turkestanica* (Table 1) also occurred as dominants or co-dominants in a forest soil (loc. 10), in tillable fields and arable lands (loc. 9, 15) and in a semi-desert soil (loc. 13). *Anabaena sphaerica* f. *conoidea* dominated only once in the soil collected near the Samara Reservoir (loc. 12). *Microcystis* often occurred as co-dominant or sub-dominant or was abundantly developed in soils from forests or under trees (loc. 8, 10, 13, 23), arable lands (loc. 6, 15), tillable fields (loc. 9, 25) and from a steppe (loc. 5). *Plectonema puteale* became abundantly developed once, after 5 months of cultivation in a sample from 8 locality.

Green algae also occurred as dominants, co-dominants or subdominants in some of the processed samples. *Leptosira terrestris* dominated or co-dominated the soils from untillable fields (loc. 1, 32), a tillable field (loc. 26) and a forest soil (loc. 31). *Cylindrocapsa* sp. dominated in the soil sample collected among the Babylon ruins (loc. 11) and was a sub-dominant in the soil from an arable land (loc. 15). *Sphaeroplea soleirolii* dominated in the soil collected under a group of oak trees (loc. 17). *Protoderma sarcinoidea* was a sub-dominant in the same soil (loc. 17) and dominated in a soil from a tillable field (loc. 29). Some green algae occurred as co-dominants or subdominants in soils collected from semi-deserts (loc. 16 - *Apatococcus lobatus*), under single trees or shrubs (loc. 3 - *Desmococcus olivaceus*, 17 - *Chloroclonium gloeophyllum*) and arable lands (loc. 28 - *Apatococcus constipatus*). During this study chlorophytes had not been found as monodominants in the soils collected from steppes, meadows and untillable fields.








The taxonomic structure of the investigated algal flora based on the number of infrageneric and generic taxa is shown on Fig. 2. During the study, some deviations from the descriptions of species and other infrageneric taxa have been detected. Since the modification of algae under culture conditions is a well known phenomenon and since many species occur in nature in different morphological stages (status), which are influenced by environmental conditions and/or are seasonally dependent (KOMÁREK & ANAGNOSTIDIS, 1999), new taxa have not been described. In the same time, some of the species found yet have not been reported from soil local-

Table 2

NS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
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Table 2
Similarity of the studied sites according to the index of Sørensen -SSI

NS/1-32 - number of site in compliance with the number in the text and in Table 1; diagonally - number of species for each site; above the diagonal - number of common species; below the diagonal - graphic expression of the values of SSI

	SSI = 0
	0.1% < SSI < 10%
	10% < SSI < 20%
	20% < SSI < 30%
	30% < SSI < 40%
	40% < SSI < 50%
	50% < SSI < 60%

ities. All deviations and all peculiarities found will be noted in details and illustrated elsewhere. In spite of using of soil-cultures, some algae could not be correctly and certainly determined due to their appearance in single specimens or in resting stages only, or due to the lack of zoospores in cultured material. Doubtless, further, more detailed studies of these cultures could reveal much more rich species composition. It has to be underlined that the pattern of algal flora obtained during this study reflected not only the environmental conditions of the studied sites, the sampling period and the physical conditions of culturing but also the 19-years keepment of the collected samples in air-dry conditions.

According to the number of infrageneric taxa (Fig. 2B) Cyanoprokaryota is the most rich group (58 species and 4 forms) while according to the number of genera (Fig. 2A) Chlorophyta is the most significant group (40 genera). Chrysophyta is very poorly represented in the studied samples (6 species of 6 genera). This result is on conformity with the general considerations about the members of soil algal flora of METTING (1981). Our results coincided also with the statement of METTING (1981) based on more than 30 publications that blue-green and green algae are well adapted for existence in climatic zones and local microenvironments in which available water is the primary limiting factor. The ability of soil cyanoprokaryotes and green algae to survive prolonged periods without water has been demonstrated by the successful revival of algae from stored soils and herbarium sheets up to 87 years of age (see the Introduction). Circumstantial evidence that Chrysophyta (particularly diatoms and yellow-green algae) are less tolerant of low water potential includes their low abundance and diversity in soils of dry regions (LUND, 1945, 1947; BREDEMUEHL, 1949; FRIEDMANN & GALUN, 1974) and their greater susceptibility to desiccation in laboratory tests (BRISTOL-ROACH, 1928; SKINNER, 1932; HILTON & TRAINOR, 1963; TRAINOR, 1970; STARKS et al., 1981; TRAINOR & GLADYCH, 1995). Many suggestions have been proposed about the physiological and biochemical mechanisms of drought resistance of soil algae. Among these are the forming of specialized resting cells, the excretion of extracellular mucilage (envelopes and sheaths), the aggregation of cells and trichomes, etc., as well as the fact that a certain number of individuals are retained in the resistant state at all times (FRITSCH, 1916, 1922; PETERSEN, 1935; MACENTEE et al., 1972; METTING, 1981; STARKS et al., 1981). It is noteworthy to mention that all these devices have been observed during the study for almost all algae and that some

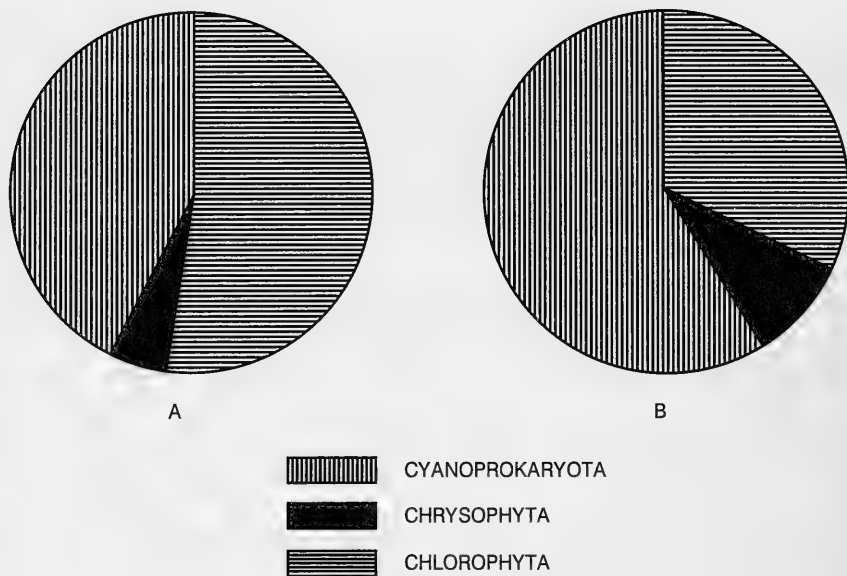


Fig. 2. Taxonomic structure of the soil algal flora of the studied sites: A - based on the number of genera, B - based on the number of infrageneric taxa

of the established species occurred mostly in a resistant state (e.g., *Leptosiropsis torulosa*, *Pseudodendroclonium akinetum*). Some cyanoprokaryotes which normally do not form mucilage sheaths, have been found in thick, yellow to brownish coloured sheaths (*Anabaena oscillarioides* f. *minor*, *Cylindrospermum licheniforme*, *C. muscicola*). The only one detected diatom species (*Gomphonema* sp.) was also in thick mucilage envelopes and stalks. For some of the detected species certain resting stages had not been reported but they themselves had thick cell envelopes or walls which, most probably, maintained their survival during the long-term air-dry conditions (e.g., *Chlorogibba pentagonia*, *Pleurogaster lunaris*, *Keriochlamys styriaca*, *Tetraedron minimum*, *Scotiella tuberculata*, *Thorakomonas* cf. *irregularis*).

The results obtained about the species composition of various sites and particularly these in small forests and under trees and shrubs generally coincided with the suggestion that macrovegetation may influence the surrounding algal flora (SCHTINA, 1956; FAIRCHILD & WILLSON, 1967; CARSON & BROWN, 1978; STARKS et al., 1981). Since the number of studied sites of this type was small we should not go into deep discussion of this problem. We should mention only that there were obvious differences in the algal flora under different vascular plants and that the sample collected under a group of oak-trees could not be grouped together with almost all other samples. This is in conformity with some results of SHUBERT (1979 - cit. acc. to STARKS et al., 1981) that a similarity-index of algal community relationships demonstrated that all woodland types grouped together

except bur oak and with the results of DRAGANOV et al. (1992) that algal flora under *Querceto-Ulmetum* showed the lowest similarity with the edaphic algae collected under other associations. In the same time, it is necessary to mention that the "specific algal associations" pointed out for some forests (e.g. METTING & RAYBURN, 1979), have been found also in areas with vastly different vegetation and soil types (STARKS et al., 1981).

Most of the algae found have been referred as ubiquitous and cosmopolitan. For most of them previous data on their preference to soil type or to the type of habitat were confirmed. The possibilities for survival after long-term keepment in air-dry conditions both for cyanoprockaryotes and green algae were confirmed and were shown also for some chrysophyte species. Nevertheless of generally common conclusions and coincidence of our results with these of other authors, there were some differences which concerned mainly details in the distribution of separate species. In the same time, detailed comparison of the detected species composition with other floristic data would not be certain due to the lack of other studies on dessicated material from the same region. A broader discussion on the distribution of the species found combined with more taxonomic data will be provided further on.

As a conclusion, it could be stated that the finding of 114 species and 4 forms from 68 genera of 3 divisions from 32 sites expand the knowledge on the edaphophyton of Southwest Asia. The results from this study confirmed some previous data about the surveillance of soil algae for a long time in museum samples kept for a long time in air-dry conditions and proved the possibility to use such samples for obtaining a valuable floristic information.

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Author's address:

Dr Maya Stoyneva

Sofia University "St Kl. Ohridski"

Faculty of Biology, Department of Botany

8, Dragan Zankov Blvd

1421 Sofia, Bulgaria

e-mail: mstoynev@techno-link.com

Почвени водорасли в музейни проби от някои пунктове в Югозападна Азия. I

Майя СТОЙНЕВА

(Резюме)

В статията са представени данни за видовия състав на водораслите в музейни проби от 32 пункта в Турция, Ирак, Иран, Сирия и Ливан. Пробите са събрани от повърхностния почвен слой през периода 30 октомври - 21 декември 1972. Резултатите са получени след обработването на материалите след 19-годишен престой във въздушно сухо състояние. Определени са 114 вида и 4 форми от 68 рода на 3 отдела. Сред тях Cyanoprokaryota е най-богат на вътреродови таксони (58 вида и 4 форми), Chlorophyta заема първо място според броя на установените родове (40), а отдел Chrysophyta е представен много бедно в изследваните проби (6 вида от 6 рода). Потвърдени са данни на предишни изследователи за предпочитанията към определен почвен тип или към типа на местообитанието за повечето от установените водорасли. Потвърдена е способността на цианопрокариотите и хлорофитите за преживяване след продължително съхранение във въздушно сухо състояние и е установено, че такива възможности имат и някои от хризофитите.

Нови хорологични данни за редки и защитени видове висши растения в България

Васил ВУТОВ, Димитър ДИМИТРОВ

При ревизия на хербарни материали в хербариума на СУ "Св. Климент Охридски" (SO) установихме нови находища на 16 вида висши растения. От тях един вид е с категория застрашен и защитен *Limonium latifolium* (Sm.) O.Kuntze. Категория рядък и защитен имат шест вида: *Mespilus germanica* L., *Nepeta ucrainica* L., *Orchis papilionacea* L., *Potamogeton trichoides* Cham. et Schlecht., *Goniolimon collinum* (Griseb.) Boiss. in DC., *Limonium gmelinii* (Willd.) O.Kuntze. Два вида са с категория рядък: *Oenanthe lachenalii* Gmel. и *Hieracium stefanoffii* Zahn. Видът *Knautia midzorensis* Form. е балкански ендемит, а *Hieracium stefanoffii* Zahn. е български ендемит. Четири вида са суббалкански ендемити: *Lysimachia atropurpurea* L., *Knautia orientalis* L., *Lathyrus hallersteinii* Baumg., *Knautia dinarica* (Murb.) Borb. и два са включени в Приложение II на CITES: *Gymnadenia conopsea* (L.) R.Br. и *Orchis pallens* L.

6540.26390. *Potamogeton trichoides* Cham. et Schlecht., GN-02, SV (N.Vihodcevski), SO 82850, SO 02750.

Софийски район: с. Казичене, местността Курнята западно от сектора до новостроящия се авторемонтен завод. Добре запазени блатца, 11.08.1967 г.; в блатама до с. Казичене, 15.08.1968 г. Досега е известен от Дунавска равнина и Тракийска низина (АНДРЕЕВ, 1992).

5790.23560. *Orchis pallens* L., FN-73, SV (D.Jordanov), SO 14003.

Софийски район: из млади гори на Раковишка могила южно от с. Росоман, Софийско, 07.04.1944 г. Досега този вид е известен за флорните райони на Прегбалкан, Стара планина, Знеполски район, Витоша, Западни гранични планини, Беласица, Славянка, Пирин, Рила, Средни Родопи (АНДРЕЕВ, 1992).

5790.23570. *Orchis papilionacea* L., KG-95, SV (S.Georgiev), SO 14032; MG-22, SV (B.Kitanov), SO 32503.

Родопи: с. Пастуша (Перущица), 05.1899 г.

Тракийска низина: по тревисти места в местността "Старите лозя" между с. Мезек и Свиленград, 23.05.1940 г. Досега този вид е познат от Прегбалкан, Западна и Средна Стара планина и Софийски район (АНДРЕЕВ, 1992).

3720.15820. *Gymnadenia conopsea* (L.) R. Br., FN-92, SV (S.Georgiev), SO 14309; FN-92, SV (D.Jordanov), SO 14311.

Лозенска планина: до Германския манастир, 12.06.1888 г.;

Софийски район: из ливади около Казиченското блато, Софийско, 11.06.1932 г. Досега този вид е познат от Прегбалкан, Стара планина, Знеполски район, Витоша, Западни гранични планини, Беласица, Славянка, Пирин, Рила, Родопи (АНДРЕЕВ, 1992).

5250.21850. *Mespilus germanica* L., NG-68, SV (D.Jordanov), SO 36146; NG-68, SV (N.Vihodcevski), SO 36149.

Черноморско крайбрежие: из дълбоката гора на Маслен нос, южно от Созопол, 05.08.1921 г.; в гора под местността "Калето" до р. Ропотома, 18.05.1968 г. Досега този вид е известен от Странджа (МАРКОВА, 1992). ЙОРДАНОВ (1973) го споменава за Бургаско и Малко Търновско.

4540.19430. *Lathyrus hallersteinii* Baumg., LN-63, SV (I.Neicev), SO 46793.

Средна Стара планина: Арманкая, край поток, 07.1903 г. Досега този вид е известен от Западни и Средни Родопи.

5860.23010. *Oenanthe lachenalii* Gmel., FN-34, SV (D.Jordanov, A.Janev), SO 92605.

Знеполски район: Трън: Малък Руй и с. Ломница, 18.07.1961 г. Досега този вид е известен от Витоша и Тунджанска хълмиста равнина (ПЕЕВ, 1992).

5030.20950. *Lysimachia atropurpurea* L., FM-85, SV (I.Penev), SO 57192.

Рила планина: по чакълести места покрай р. Благоевградска Бистрица, в с. Бистрица, 620 м надм. в., 07.06.1956 г. Този вид се посочва за Рила планина (ПЕЕВ, 1982).

3680.15760. *Goniolimon collinum* (Griseb.) Boiss. in DC., LH-81, SV (G.Asmanov), SO 98978.

Средна Стара планина: над град Мъглиж, 30.07.1997 г. Досега този вид е известен от Черноморско крайбрежие, Североизточна България, Източна Стара планина, Знеполски район, Струмска долина, Източни Родопи, Тунджанска хълмиста равнина и Странджа (АНЧЕВ, 1992).

4790.20110. *Limonium gmelinii* (Willd.) O. Kuntze, MH-71, SV (D.Jordanov), SO 57640; MH-30, SV (D.Jordanov), SO 57641.

Тунджанска хълмиста равнина: по тревисти места по периферията на Стралджанското блато, 22.08.1929 г.; по солените почви на низината южно от гара Кермен, Сливенско, 13.07.1933 г. Досега този вид се посочваше за този флорен район (АНЧЕВ, 1992).

4790.20140. *Limonium latifolium* (Sm.) O. Kuntze, MG-78, SV (D.Jordanov), SO 57765.

Тунджанска хълмиста равнина: по сухите части на ливадите около с. Робово, Елховско, 27.07.1929 г. Видът се посочва от УРУМОВ (1917) за този флорен район.

5580.22780. *Nepeta ucrainica* L., LJ-52, SC (SK, DD), SO 95552.

Дунавска равнина: по скалист терен на Черната могила между селата Овча могила и Драгомирово, Свищовско, 21.06.1991 г. Досега този вид е известен от Черноморско крайбрежие, Североизточна България и Предбалкана (МАРКОВА, 1992).

4410.18930. *Knautia dinarica* (Murb.) Borb., FN-20, SV (D.Jordanov, A.Janev), SO 99800.

Знеполски район: Милевска планина, 31.07.1960 г. Досега този вид е известен от Рила планина (ПЕТРОВА, 1992).

4410.18970. *Knautia midzorensis* Form., FN-43, SV (D.Jordanov, A.Janev), SO 98156.

Знеполски район: Парамунска планина, 04.08.1961 г. Досега този вид е известен от Средна и Западна Стара планина, Витоша, Западни гранични планини, Пирин, Рила, Западни и Средни Родопи (ПЕТРОВА, 1992).

4410.18980. *Knautia orientalis* L., MH-42, SV (S.Georgiev), SO 71312.

Източна Стара планина: полянка при Сините камъни, Сливенско, 18.07.1888 г. Досега този вид е известен от Черноморско крайбрежие, Източни Родопи, Тракийска низина, Тунджанска хълмиста равнина и Странджа (ПЕТРОВА, 1992).

3950.17280. *Hieracium stefanoffii* Zahn., GM-03, SV (B.Stefanov, T.Georgiev), SO 81243.

Северен Пирин: по варовици на връх Кутела, 09.08.1932 г. Досега този български ендемит е известен от Средна Стара планина, Витоша, Западни гранични планини и Рила (ПЕВ, 1992).

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Адреси на авторите:
Васил Вутов
Национален природонаучен музей - БАН
бул. Цар Освободител 1
1000 София

Димитър Димитров
Софийски университет "Кл. Охридски"
Биологически факултет
бул. Драган Цанков 8
1421 София

New chorological data for rare and protected vascular plant species in Bulgaria

Vasil VUTOV, Dimitar DIMITROV

(S u m m a r y)

There were found new localities of 16 species of vascular plants during the revision of the herbaria materials from the Herbarium of Sofia University "St. Kliment Ochridski". Species were studied according their area of distribution. One of them has category endangered and protected: *Limonium latifolium* (Sm.) O. Kuntze; six species have category rare and protected: *Mespilus germanica* L., *Nepeta ucrainica* L., *Orchis papilionacae* L., *Potamogeton trichoides* Cham. et Schlecht., *Goniolimon collinum* (Griseb.) Boiss. in DC., *Limonium gmelinii* (Willd.) O. Kuntze; two have only category rare, but one of them is the Bulgarian endemic *Hieracium stefanoffii* Zahn. The species *Knautia midzorensis* Form. is Balkan endemic and four other species are sub-Balkan endemics. Two species are included in Appendix II of CITES: *Gymnadenia conopsea* (L.) R. Br. and *Orchis pallens* L.

Нови хорологични данни за разпространението на висши растения с природозащитен статус в България

Васил ВУТОВ, Димитър ДИМИТРОВ

Съобщават се нови находища на 19 вида висши растения. Таксоните са проучени от различни флористични райони в България. От тях един вид е с категория застрашен и защитен - *Tulipa urumoffii* Hay. Български ендемити са: *Pyrus elaeagnifolia* Pall. subsp. *bulgarica* (Khutath. et Sachok.) Valev, *Sempervivum erythraeum* Vel., *Rosa parilica* Dimitrov. Балкански ендемити са: *Silene fabarioides* Hausskn., *Silene roemeri* Friv., *Trifolium pignanii* F. et Chaub. Балкански субендемити са: *Senecio othone* M.B., *Silene lerchenfeldiana* Baumg., *Trifolium dalmaticum* Vis. Видове с категория рядък са: *Vicia dumetorum* L., *Vicia pisiformis* L., *Pyrola rotundifolia* L., *Silene chlorantha* (Willd.) Ehrh. От категорията рядък и защитен е вида *Pulsatilla pratensis* L. От категорията защитени видове са *Stachys arenariaeformis* Rouy и *Utricularia minor* L. Вид включен в Бернската конвенция е *Salvinia natans* (L.) Allioni.

Хербарните материали се съхраняват в Хербариума на Софийския университет (SO).

7110.30040. *Salvinia natans* (L.) Allioni, NH-38, SV (D.Jordanov), SO 01063; KG-77, SV (N.Petkov), SO 98970.

Черноморско крайбрежие: в периферията на южните части на Енидже къйското блато (с. Златина, Варненско), 07.08.1931 г.;

Тракийска низина: в бившото Държавно рибовъдно стопанство между Пазарджик и с. Звъничево, 12.10.1997 г. Този хидрофит е известен досега от Черноморско крайбрежие, Североизточна България, Дунавска равнина, Струмска долина и Тракийска низина (АНДРЕЕВ, 1992).

8300.35510. *Tulipa urumoffii* Hay., NH-21, SV (D.Jordanov), SO 12239; FN-40, SV (I.Koeva), SO 93532.

Тунджанска хълмиста равнина: покрай ж.п. линия около гара Каяли (с. Камено) Бургаско, 05.05.1932 г.;

Знеполски район: Земенска планина - по тревисти варовити склонове пог връх Мечка, 27.04.1986 г. Този застрашен и защитен вид е известен от флорните райони Източна Стара планина и Знеполски. КИТАНОВ (1964) съобщава находището при с. Камено, Бургаско, но ПЕТРОВА (1992) не включва това находище към хорологията на този вид.

7510.32000. *Silene chlorantha* (Willd.) Ehrh., FN-91, SV (D.Jordanov), SO 20435.

Витоша: по тревисто каменисти места на възвишението Църква, източно от с. Симеоново, Софийско, 20.06.1955 г. Досега този рядък вид е известен от Средна гора и Тракийска низина (ЙОРДАНОВ, ПАНОВ, 1966; ПЕТРОВА, 1992).

7510.32120. *Silene fabarioides* Hausskn., FN-91, SV (I.Gancev), SO 84905; GL-19, SC (DD), SO 94490.

Лозенска планина: по ерозирани каменливи места над ВЕЦ "Кокаляне", силикат, 27.05.1956 г.;

Южен Пирин: по варовити скалисти места на южен склон на Сухи връх, 1350 м надм.в., 05.07.1989 г. Досега този балкански ендемит е известен от флорните райони Знеполски, Витошки, Славянка, Средни Родопи и Тракийска низина (ЙОРДАНОВ, ПАНОВ, 1966; ПЕТРОВА, 1992).

7510.32200. *Silene lerchenfeldiana* Baumg., FN-81, SV (B.Kitanov), SO 21063.

Витоша: по скални пукнатини на Черната скала, 26.07.1938 г. Досега този балкански субендемит е известен от Предбалкан, Западна Стара планина, Знеполски район, Западни гранични планини, Пирин, Рила, Средна гора, Западни и Средни Родопи и Тракийска низина (ЙОРДАНОВ, ПАНОВ, 1966; ПЕТРОВА, 1992).

7510.32270. *Silene roemerii* Friv., GN-01, SV (B.Nikolov), SO 98914; GN-81, SV (N.Vihodcevski), SO 44927.

Лозенска планина: по скали над Горни Пасарел, 07.1996 г.;

Лозенска планина: полянки сред рядка гора в източното подножие на връх Лалина могила, 09.09.1973 г. Досега този балкански ендемит е известен от Средна Стара планина, Софийски район, Витоша, Западни гранични планини, Пирин, Рила, Западни и Средни Родопи (ЙОРДАНОВ, ПАНОВ, 1966; ПЕТРОВА, 1992).

6700.27130. *Pulsatilla pratensis* L., NJ-28, SV (D.Michailov), SO 23340.

Североизточна България: по хълма Кара Бунар, Силистренско, 20.04.1994 г. Досега този рядък и защитен вид е известен от Витошки район (АНЧЕВ, 1992).

7390.31360. *Sempervivum erythraeum* Vel., GM-46, SV (S.Mirova), SO 33601; SV (D.Jordanov), SO 33607; FN-82, SV (D.Jordanov), SO 33603; FN-72, SV (I.Gancev), SO 83905; FN-82, SV (N.Vihodcevski), SO 33609.

Западни Рогопи: по пукнатини на скали по планинския масив Алабак, 19.07.1953 г.;

Западни Рогопи: Казан госа, 09.08.1934 г.;

Люлин планина: каменисти места по южните склонове над Владайското дефиле, 16.09.1934 г.;

Люлин планина: по скалисти места в местността "Градището", андезитна скала, 20.07.1947 г.;

Витоша: припечни, каменисти места по северния склон на Копитото, 11.07.1972 г. Досега този български ендемит е известен от Средна и Западна Стара планина, Беласица, Пирин, Рила (АНДРЕЕВ, 1992).

7390.31390. *Sempervivum zelleborii* Schott., NG-75, SV (D.Jordanov), SO 33622 (Sub *S. ruthenicum* Koch).

Странджа: по големите силикатни скали северозападно от село Бродилово, Малко Търновско, 22.07.1934 г. Досега този медитерански вид е известен от Черноморско крайбрежие, Източна Стара планина, Южната част на Струмска долина, Източни Рогопи и Тунджанска хълмиста равнина (АНДРЕЕВ, 1992).

6740.27320.5970. *Pyrus elaeagrifolia* Pall. subsp. *bulgarica* (Khutath. et Sachok.) Valev, FN-82, SV (N.Vihodcevski), SO 32803, SO 32804.

Люлин планина: по склоновете над с. Владая, 02.09.1962 г.;

Люлин планина: по склона над с. Княжево, Софийско, 11.09.1968 г. Досега този български ендемит е известен от Черноморско крайбрежие, Източна Стара планина и Странджа (МАРКОВА, 1992).

6980.28770. *Rosa parilica* Dimitrov, GM-10, SC (DD), SO 97028.

Среден Пирин: по скалисти варовити места под връх Малка Баба, 1800 м надм. в., 22.07.1983 г. Досега този български ендемит е известен от Славянка (МАРКОВА, 1992).

8220.34810. *Trifolium dalmaticum* Vis., GN-37, SV (S.Grancarov), SO 84206; GN-28, SV (I.Penev), SO 41271.

Прегбалкан: край с. Караш, Луковитско, 07.1926 г.;

Прегбалкан: по сухите карстови пасища около с. Царевец, Мездренско, 26.06.1960 г. Досега този балкански субендемит е известен от Дунавска равнина, Западна Стара планина, Софийски район, Знеполски район, Западни гранични планини, Струмска долина и Тракийска низина (КОЖУХАРОВ, 1992).

8220.35070. *Trifolium pignanii* F. et Chaub., FM-62, SV (A.Janev), SO 85691.

Западни гранични планини: Малешевска планина - по горски поляни, 17.05.1963 г. Досега този балкански ендемит е известен от Струмска голина (южна), Беласица, Пурин, Рила, Западни и Средни Родопи (КОЖУХАРОВ, 1992).

8540.37040. *Vicia dumetorum* L., LH-96, , SV (N.Vihodcevski), SO 90814; NJ-26, SV (B.Kitanov), SO 99614; FP-63, SV (D.Jordanov, B.Kitanov), SO 44486.

Предбалкан: из храсталаците край гората срещу местността "Вилите" го с. Малък Чифлик, Велико Търновско, към 180 м надм. в., варовик, 19.10.1982 г.;

Североизточна България: в гората Каракуз, Силистренско, 26.07.1973 г.;

Дунавска равнина: из млади гори в силно влажния дол източно от с. Луковица, Ломско, 19.10.1950 г. Досега този рядък вид беше под въпрос за Дунавска равнина, а е известен от Североизточна България, Западен Предбалкан, Западна Стара планина, Знеполски район, Витоша, Рила, Западна Средна гора (КОЖУХАРОВ, 1992).

8540.37160. *Vicia pisiformis* L., NJ-26, SV (B.Kitanov), SO 99803.

Североизточна България: в гората Каракуз, Силистренско, 26.07.1973 г. Досега този рядък вид е известен от Североизточна България, Предбалкан и Витоша (КОЖУХАРОВ, 1992).

7720.33130. *Stachys arenariaeformis* Rouy, LJ-52, SV (DD), SO 95691.

Дунавска равнина: по източния склон на Черната могила при с. Драгомирово, Свищовско, 19.06.1990 г. Този защитен вид е известен от Никополско (КОЕВА, 1989).

6730.27280. *Pyrola rotundifolia* L., LH-13, SV (S.Baev), SO 83604.

Средна Стара планина: Троянска планина, 06.1901 г. Досега този рядък вид е известен от Витоша (АНЧЕВ, 1992).

8410.35740. *Utricularia minor* L., GM-18, SV (S.Georgiev), SO 68673.

Рила: до пътя от р. Марица за Боровец, 24.08.1897 г. Досега този защитен вид е известен от Знеполски район, Витоша, Пурин, Западни Родопи (МАРКОВА, 1995).

7400.31480. *Senecio othone* M. B., MH-58, , SV (D.Jordanov), SO 76615.

Дервентски проход: из смесени гори, Търговишко, 25.06.1923 г. Досега този балкански субендемит е известен от Източна и Средна Стара планина, Рила, Източна Средна гора, Източни Родопи и Тунджанска хълмиста равнина (ПЕЕВ, 1992).

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Агреси на авторите:

Васил Вутов

Национален природонаучен музей при БАН

бул. Цар Освободител 1

1000 София

Димитър Димитров

Софийски университет "Климент Охридски"

Биологически факултет, катедра Ботаника

бул. Драган Цанков 8

1421 София

New chorological data for the distribution of vascular plants with conservation status in Bulgaria

Vasil VUTOV, Dimitar DIMITROV

(S u m m a r y)

New localities of 19 vascular plants species were found during the revision of the herbaria materials from the Herbarium of Sofia University "St. Kliment Ochridski". Four of them are Bulgarian endemics: *Pyrus elaeagnifolia* Pall. subsp. *bulgarica* (Khutath. et Sachok.) Valev, *Sempervivum erythraeum* Vel., *Rosa parilica* Dimitrov; three are Balkan endemic *Silene fabarioides* Hausskn., *Silene roemerii* Friv., *Trifolium pignanii* F. et Chaub.; three are sub-Balkan endemics *Senecio othonis* M.B., *Silene lerchenfeldiana* Baumg., *Trifolium dalmaticum* Vis. and nine are categorized as rare, endangered or protected species.

Палеоорнитологията и археорнитологията камо направления в палеозоологията

Златозар БОЕВ

Още първият български палеонтолог, проф. Петър Бакалов определя палеонтологията като биологична дисциплина (БАКАЛОВ, 1928). Тя обаче все още е една от най-слабо развитите области на научното познание. Според Соколов (1977) през 1976 г. в света са работили около 6000 палеонтолози - специалисти по изкопаемите растения, безгръбначни и гръбначни животни. По данни на Информационния бюлетин на международното Дружество по палеонтология и еволюция на птиците (SAPE) за 1988 г. в света в посочената област са работили 144 специалисти (т.е. едва 2,4 % от всички палеонтолози). Три четвърти от тях обаче публикуват изследвания и върху останалите класове гръбначни животни. Броят на палеоорнитолозите, специализирали се единствено върху изкопаемите птици от различни периоди и различни географски области, е не повече от 45-50. Това говори за оскъдността на знанията ни за палеонтологията и еволюцията на птиците въобще и определя палеоорнитологията като една млада и много перспективна научна област. По данни на UNWIN (1988) през периода 1900-1950 г. в света годишно се публикували от 0 до 5 палеоорнитологични публикации, между 1950 и 1975 г. - по около 10 публикации, а след 1975 г. - между 15 и 40 публикации по фосилните птици. По наши данни от началото на 90-те години ежегодно се публикуват по 55-60 и повече научни статии върху палеонтологията и еволюцията на птиците.

Соколов (1977) отбелязва: „На непосредствено изучаване от палеонтолога се подлагат вкаменелостите и следите от жизнената дейност на организмите, палеоценозите и изкопаемите локални популации, видовете и таксономичните системи, целият ход на еволюцията и биогеографската диференциация на органическия свят в геологичното минало. Следователно палеонтологът е палеобиолог ... и нито за минута не трябва да забравя, че съвременната биологична теория е също и негова теория“. „Описанието на изкопаемите организми е неотделимо от описанието на съвременните животни и растения“

(Коробков, 1978, с. 7). СПАССКИЙ (1977) определя, че палеонтологията като биологическа наука е създадена от еволюционната теория. Още в началото на настоящото столетие палеобиологията се определя като дисциплина, изучаваща начина на живот на организмите и отношенията им с условията на обкръжаващата ги палеосреда (Abel, 1912, по НИКОЛОВ, 1977). НИКОЛОВ (1977) не разграничава палеобиологията от палеоекологията, но за предмет на последната той определя: начина на живот на организмите в миналото, възстановяването на условията за съществуването на организмите и целите съобщества, еволюцията на екосистемите, взаимоотношенията между организмите, границите на разпространение, числеността на популациите, влиянието на средата върху морфологията, темповете на видообразуването, направленията на еволюционния процес на филогенетичните линии, дивергенцията и конвергенцията, разселването на организмите - причини, скорост, последствия. По-кратко формулирано, палеоекологията е наука за начина и условията на живот на организмите от геологичното минало, за тяхната зависимост от условията на живот, или наука за взаимовръзките между отделните организми и техните комплекси в миналото (ГЕККЕР, 1977). Палеоекологичният синтез според ИВАНОВСКИЙ (1977) се занимава и с интерпретация на фосилните останки в зависимост от условията на средата, обвързване на палеоекологичните данни с тези от палеогеографията, с географското разпространение на видовете, с характера на различните биотопи и пр.

Във всички случаи, анализът се основава на изследването на фосилни и субфосилни останки от организмите. За палеоорнитолога такива могат да бъдат: цели птичи скелети, кости от отделни части на тялото (крайници, глава), единични кости, отпечатъци от пера, следи от краката, яйчни черупки, гастролити, мумифицирани трупове или части от тях. Затова фосилите най-общо се определят като запазили се останки от доисторически растителен и животински свят. Понятието „доисторически“ обхваща времето на геологическото минало до холоцена (започнал преди около 10 000 години) (КРУМБИГЕЛЪ & ВАЛТЕР, 1980).

Независимо от принадлежността им към измрели или днес съществуващи видове, фосилите имат различна степен на съхраненост. „Фосил“ е изключително времево понятие, противопоставяно на понятието „рецентен“, отнасящо се до днес живеещите растения и животни. Според МАКРИДИН и МЕЙЕН (1988) историческата неразривна връзка, съчетала биотичните и абиотичните условия, е изкопаемата биофация - съвкупността от останките на организмите, свързана с определена фация, т. е. към утаечните скали с определен литологичен състав. Напоследък по-широко разпространение добива определението на STEADMAN (1985) за фосилните птици. Според него „Фосилни птици са всички

представители на класа Aves, чиито останки са запазени в палеонтологичния контекст. Те обхващат периода от юра допреди само няколко хилядолетия и за такива могат да се разглеждат всички птичи останки, които не са съпроводени от писмена историческа документация“. Както личи, субфосилните птици се отнасят към категорията на фосилните, които като цяло се противопоставят единствено само на рецентните.

Въпреки че фосилни птици са били описани още в първите трудове на Жорж Кювие, делът на палеоорнитологията и в наши дни, както се отбелязва по-горе, е все още твърде незначителен. Сред основните причини са дребните размери за по-голямата част от представителите на класа, слабата фосилизация и необходимостта от наличието на големи сравнителни остеологични колекции.

Безспорно, по тафономични причини, геологичната летопис на птиците е доста фрагментарна и несравнимо по-непълна, отколкото геологичната летопис на бозайниците или влечугите (ДАВИТАШВИЛИ, 1969). Размерният диапазон на представителите на отделните разрези, както и екологичните предпочитания на видовете са определяли и неравномерното представяне на птиците във фосилните останки. Затова сравнително пълни са палеонтологичните данни за щраусовите и останалите разрези от групата Ratitae на едрите нелетящи бягащи птици, както и пеликаноподобните (Pelecaniformes), жеравподобните (Gruiformes), соколподобните (Falconiformes) и някои групи. Обратно, дендрофилните птици, обитаващи горски местообитания, често притежаващи дребни телесни размери, поради повишената киселинност на горските почви и незначителните им по размер кости, са почти непознати във фосилно състояние. Освен врабчоподобните (Passeriformes), слабо познати на палеонтологите са и кълвачоподобните (Piciformes), синявчоподобните (Coraciiformes), кукувицоподобните (Cuculiformes) и др. Както отбелязва КУРОЧКИН (1971), труповете на птиците, които са започнали да се разлагат, дълго плават по повърхността на водата, а това изключва тяхното възможно включване в утайките, изолирането на кислорода и последващата фосилизация. Мъртвите бозайници, влечуги и земноводни потъват и поради тази причина, както и поради плътните им кости, дават по-многобройни фосили в сравнение с птиците.

Първите публикации по субфосилни и фосилни птици в редица страни на Европа и Азия се появяват твърде късно в сравнение с тези за останалите класове гръбначни животни. Така например и в трите прибалтийски държави (Естония, Латвия и Литва) костните останки от птици от археологичните и палеонтологичните находища са били напълно неизучени допреди четиридесетина години, когато ПЛАВЕР (1959) за първи път съобщава някои данни за холоценските останки от някои хидрофилни

видове птици от мезолитни (7000-6000 г. пр. н.е.) находища. Първата подобна публикация за птиците от територията на днешна Русия е на А. Иностранцев от 1882 г. за неолитни останки от 19 вида птици от брега на Ладожкото езеро. За Молдова първата подобна работа е тази на ЛАСКАРЕВ (1908), който съобщава за находка от ескулаповата кокошка (*Gallus aesculapi*), впоследствие отнесена към род *Pavo*. За страните от Средна Азия (Казахстан, Узбекистан, Киргизстан, Туркменистан и Таджикистан) първата публикация за субфосилните и фосилните птици е тази на СУСЛОВА (1949), за палеолитната (мустер) пещера Ташик-Таш в Южен Узбекистан, откъдето съобщава 19 вида птици. Това са и първите данни за плейстоценските птици в Средна Азия въобще.

Макар че изследването на птиците костни останки вече има едновековна история, може да се смята, че развитието на палеоорнитологията започва с по-осезаеми темпове едва през 70-те години. Преди това изследванията върху историята на регионалните орнитофауни и палеонтологията на птиците въобще бяха изключителна рядкост. Така например измежду 700-те доклада, представени на Четвъртата (1965) и Петата (1969) всесъюзни орнитологически конференции в бившия Съветски съюз, само 7 са били с палеоорнитологична тематика или са засягали въпроси на историята на формирането на авифауната (ТАТАРИНОВ & МАРИСОВА, 1971). Това означава, че едва 1 % от изследванията могат да се отнесат в разглежданата област.

Споменатите по-горе трудности не са непреодолими и палеоорнитологията, макар и по-бавно, непрестанно е била в развитие към прогрес. Така например към 1933 г. са били известни едва 691 вида фосилни птици (LAMBRECHT, 1933), в 1955 г. - 787 (WETMORE, 1955), в 1960 - 834 (BRODKORB, 1960), в 1971 - 900 (КУРОЧКИН, 1971), а днес техният брой е над 1700 вида. През 1970 г. в целия свят редовно или епизодично с палеоорнитология се занимавали 35 специалиста (КУРОЧКИН, 1971), а в началото на 90-те години те вече са 44, двама от които работят в страните от Балканския полуостров (Румъния и България). Както отбелязва RICH (1983, p. 345), „Палеоорнитологията е направлението в палеонтологията на гръбначните, което в последните години е в период на възход. Днес палеоорнитологията е надхвърлила далеч пределите от близкото минало. До 1965 г. само шепа изследователи се занимаваха с фосилните птици. Въпреки че много палеоорнитологични изследвания вече лежат в основата на таксономията на птиците, необходими са обаче още усилия за натрупването на данни за филогенията на птиците.“

Палеозоогеографията е едно от най-важните приложения на палеоорнитологията (КУРОЧКИН & ГЛІЯ, 1972; ГЛІЯ и др., 1979). Фосилните птици и особено птиците на палеогена и неогена са важен източник на сведения за палеоландшафта. Екологичните връзки и териториалната

привързаност на птиците, въпреки привидната им мобилност, са много консервативни. Птиците населяват биотопи, специфични за всеки вид, и се срещат в области с различен, но добре обособен климат. Затова орнитофаунистичните комплекси дават ценни сведения, които подобно на екологичните и климатичните са в състояние да попълнят палеоекологичната характеристика на ландшафта в района на изследваното находище (Пидопличко, 1963; VILETTE, 1983).

Историческата орнитогеография, една много близка и в голяма степен основаваща се на палеорнитологията научна област, се формира като научно направление през 20-те - 30-те години на века. Въпреки ускорените темпове на развитие по това време (М. А. Мензбир, Е. Щрезман, А. Майнерцаген, Б. К. Штегман, П. С. Серебровский, Г. П. Дементьев и др.), тя натрупва значителен обем информация, но скоро преминава в застой. На 15 международен орнитологически конгрес в 1970 г. е изтъкнато, че изследванията по историята на орнитофауните се отличават със своята трудоемкост и все още привличат твърде малко орнитолози в света.

В палеорнитологията се създава и теорията за еколого-географския изоморфизъм. Според Г. П. Дементьев тя определя еколого-климатичните условия като решаващи за еволюцията на птиците. Особеностите на ландшафта и релефа са определящи за формирането на историческото развитие на орнитофауната (Куручкин, 1979). Дементьев разработва и концепцията за политипичния вид при птиците. Той не приема класификацията на Уетмор, но я счита за най-добрата. Безкилевите (Ratitae) и останалите групи от подклас същински птици (Neornithes) според него имат много дребни различия. „... Слабото развитие на палеорнитологията ... е свързано не с отсъствието на изкопаеми материали ..., а с недостатъчното внимание към изкопаемите птици ... въобще“ (Куручкин, 1979, с. 17). Г. Дементьев поставял изследванията на плейстоценските птици и съпоставянето им със съвременните сред перспективните палеорнитологични направления. „... Той призоваваше към всестранно обогатяване на колекциите от остеологически материали по птиците, без които изследването на изкопаемите останки от птици е немислимо.“ (Куручкин, 1979, с. 18). Дементьев пръв (заедно с WETMORE, 1959) установил главните особености на плейстоценските птици: по-едри размери (по правилото на Бергман), сходство със съвременната орнитофауна и др. „Георгий Петрович постоянно призоваваше да се събират сведения за птиците от плейстоцена“ (с. 17). Поради полета, прелета и свободното си придвижване, той смятал, че птиците са идеален зоогеографски индикатор. Важна е сезонната датировка по наличието на кости на млади индивиди. „... От зоогеографска гледна точка най-насъщната задача на палеорнитологията според него беше изучаването на кватернерните птици“ (с. 18).

Археорнитологията (или орнитоархеологията, както бе прието да се нарича на Втората международна среща на Работната група по птичите останки при Световния съвет по археозоология през 1992 г. в Мадрид) изучава значението на птиците в материалния и духовния живот на хората от предишните епохи. Предмет на археорнитологичните изследвания са костните останки от птици, черупки от птичи яйца, птичи мумии, гуано, погадки, съхранили се трайни изображения на птици като каменни барелефи, метална пластика, керамика, каменни статуетки, дърворезба, стенна живопис в пещерите и пр. (DAWSON, 1969).

Палеолитните находки са от особен интерес както за археолозите, така и за археозоолозите, които по правило разкриват в тях значителен по обем и разнообразен по видоф състав материал от добиваните ловни животни. Археолозите правят както периодизация, така и хронология на палеолита. Хронологията е етапност в развитието на природата и обществото и се основава на данните от естествените дисциплини. Според ГЛАДИЛИН и СИТЛИВЫЙ (1990) периодизацията отразява само качествените промени в развитието на обществото. „Археологическият метод има тази особеност, че включва в себе си и палеонтологическия метод. В гревните палеолитни селища се налага да се изучават останки от животни и растения, добити от други хора и оставени на място или преместени на стотици и хиляди километри от мястото на произхода им.“ (ПИДОПЛИЧКО & МОЛЯВКО, 1965). Така археозоологичните изследвания дават представа за птиците, които е използвал и отглеждал древният човек, за влиянието на околната среда и развитието на животновъдството. Неорнитологът изучава рецентните птици и анализира техния съвременен състав. Палеорнитологът предоставя данни за динамиката и характерните елементи на палеофауните на птиците.

Най-обилните птичи останки с кватернерна възраст произлизат от културните пластове от палеолита и неолита, т.н. „кухненски отпадъци“ (КУРОЧКИН, 1971). По-рядко такива материали се откриват в наносните отложения по бреговете на големите реки, в карстови пещери, а още по-рядко - в открити природни нефтени и асфалтови находища. Към последния тип принадлежат добилите световна известност горноплейстоценски находища Бинагада (на Апшеронския полуостров в Източен Азербайджан) и Ранчо Ла Бреа (в Лос Анджелис в Калифорния).

Изясняването на природните условия през палеолита представлява и голям теоретичен интерес, тъй като в тези условия е протекла не само биологичната, но и социалната еволюция на човека. Както обобщава МАКЕЕВ (1963), „... що се отнася до природната обстановка, сред която е живял човекът, се опитват да я възстановят главно по костните останки на животните...“, съвременници на палеолитния човек.

За археозоологията особено интересна е неолитната сухоземна фауна на Балканския полуостров. Тя „... най-пълно отразява създадения постплейстоценски комплекс, ненакърнен съществено по състав и структура от човешката дейност“ (Спасов, лич. съобщ.). Според него той се характеризира с редукция на степните елементи, изтегляне на хладнолюбивите на север и разпространение на горските видове.

За палеоорнитолозите дълго време единственото ръководство бе изчерпателния за времето си монографичен труд на LAMBRECHT (1933). По-късно във Флорида се публикува серията от каталози за фосилните птици на BROOKOV (1963-1978), а в Москва - разделът за фосилните птици в многотомното издание „Основы палеонтологии“ на Дементьев (1964). Въпреки тези крупни обобщаващи палеоорнитологични трудове все още съществува (вкл. и сред зоолозите в България) известно недоверие в описанието на фрагментарен материал от фосилни птици и надеждността на описанията на фосилни видове по отделни единични останки от разни части на птичия скелет.

На съмнения от подобен род трябва да се противопоставят изключителната консервативност на птичия скелет и общата морфологична монокитност на птиците, свързана с полета. Индивидуалната метрична и морфологична изменчивост на птиците е с един порядък (около 10 пъти) по-ниска от тази при бозайниците например (БОЕВ, 1986). Изключения в двете посоки от тези класове са нелетящите бягащи птици (Ratitae) и ръкокрилите (Chiroptera). Първите по морфологичната си изменчивост се доближават до бозайниците, а вторите - до птиците. Новите таксони на фосилните птици се описват само по наличието на очевидни качествени различия, които позволяват с голяма увереност да се определят и кватернерните останки от рецентните видове. Както отбелязва Курочкин (1971), съществува дори обратната опасност - под едно и също название да бъдат описани няколко изкопаеми вида поради едва доловимите разлики в детайлите на морфологията или пропорциите на отделните елементи на скелета. Понякога дори е възможно като видове да бъдат описани дори фосилни родове. Според Евгений Курочкин само в този смисъл може да се говори за условност на палеоорнитологичния вид. Понякога се възразява и с „аргумента“, че се описват няколко вида птици по различни части от скелета. Тази възможност също е преувеличена и тя на практика е почти елиминирана от изключителната рядкост на останките от фосилни птици. В този случай широко се прилага методът на индексите на размерите на отделните скелетни елементи, чиито предели лесно се определят на базата на рецентни материали.

Изследването на изкопаемите птици е невъзможно без сравнителни колекции от съвременни птици. Фосилните птици находки обикновено са

гребни фрагменти - епифизи. Птиците нямат зъби и определянето „... и изучаването им е изключително трудоемка работа“ (КУРОЧКИН, 1985, с. 7). Както отбелязва авторът, индивидуалната изменчивост на скелета е минимална и това решително намалява възможността за грешки при описване на изкопаемите птици на основата на единични и фрагментарни обекти. Аеродинамичните характеристики уеднаквяват близките видове, което затруднява определянето на изкопаемите останки. Задните крайници обаче са най-информативни. Те са най-разбираеми във функционален и таксономичен план. Освен това птиците имат и изключително стабилни пропорционални отношения между размерите на отделните части на една и съща кост - индивидуалната им изменчивост е твърде незначителна, поради което вероятността за правилен резултат на определянето превишава 75 % (КУРОЧКИН, 1985). „Известна сложност представлява съпоставянето на различни части от скелета, тъй като изкопаемите кости на птиците най-често се събират като изолирани фрагменти. Затова синонимията в палеоорнитологията навярно е разпространена по-нашироко, отколкото в другите области на палеонтологията на гръбначните.“ (с. 8).

В България палеоорнитологията (в широк смисъл тя включва и археорнитологията) възниква като научно направление едва в средата на 80-те години, когато се появяват първите публикации върху фосилни и субфосилни птици от чуждестранни и наши специалисти. Днес книжнината по птиците на миналото от пределите на днешните български земи включва около 70 публикации. Засега изследванията от подобен род са съсредоточени единствено в Националния природонаучен музей при БАН, където се съхраняват около 14 000 костни останки от птици с терциерна и кватернерна възраст от Европа, Източна Азия, Южна Африка и Нова Зеландия.

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Адрес на автора:

Златозар Боев

Национален природонаучен музей при БАН

бул. Цар Освободител 1

1000 София

The paleornithology and archaeornithology as paleozoological branches

Zlatozar BOEV

(S u m m a r y)

Paleontology is a biological, but not a geological science. A short review of the development and achievements of the studies on fossil and subfossil birds of the World, East Europe and Bulgaria is presented. Less than 3 % of the paleontologists of the World study birds, but the annual number of the published scientific articles arose more than ten times since the beginning of the 20-th century. The number of the known species of fossil birds in 1996 is over 1600 (as compared to 691 species in 1933). The bibliography on Bulgarian fossil and subfossil birds consists of about 70 publications. The paleoornithology (incl. archaeornithology) in Bulgaria is a highly promising and perspective field of paleozoological investigations.

Каталог на негомерките (Lepidoptera: Geometridae) в България от Екамерина Несторова

Алекси ПОПОВ

NESTOROVA E. 1998. Lepidoptera, Geometridae. - In: Catalogus Faunae Bulgaricae. 2. Sofia - Moscow, Pensoft Publishers, 193 p.



Едва ли има друг разред от безгръбначните животни, към който да са били насочени интересите на толкова български ентомолози през всички периоди от развитието на зоологията в нашата страна, както към пеперудите. Това е причината за натрупването на достатъчен обем от данни и за семейство Geometridae, чийто видов състав е вече почти цялостно изяснен у нас. Затова и съставянето на каталог на семейството е напременно.

Екамерина Несторова се е постарала да обедини цялата налична информация и да посочи за всеки вид синонимиката и литературата за България, хоризонталното и вертикалното разпространение у нас, общото разпространение, фенологията и хранителните растения. Вертикалното разпространение е дадено чрез минималната и максималната надморска височина и чрез растителните пояси. Използвани са общоприетите у нас растителни пояси, като само поясът на ксеротермните дълбоки гори и поясът на мезофилните дълбоко-габрови гори са обединени в един пояс. Общото разпространение е посочено чрез по-големи географски категории (не зоогеографски, както е отбелязано на с. 1 в каталога).

В увода на каталога Е. Несторова съобщава за 460 установени в България вида, от които 12 вида са с недостатъчно сигурни данни. В действителност в каталога са включени 461 вида и 1 подвид или общо 462 таксона, от които 11 вида със съмнителни данни. Досега семейството е монографично разработено в България от БАХМЕТЬЕВ (1902, Тр. Русс. энт. общ., 35: 356-466), REBEL (1903, Ann. Naturh. Mus. Wien, 18: 123-347), БУРЕШ & ТУЛЕШКОВ (1936, Изв. Цар. природон. инст. София, 9: 167-240; 1937, *ibid.*, 10: 121-184), но след това са публикувани още доста видове. Съвременен списък с всички установени видове е съставен от GANEV (1983, Phegea, 11: 31-42). В този списък фигурират 424 вида, а не 425, тъй като № 28 липсва [възможно е липсващият вид да е *Idaea muricata* (Hufn.)]. По съвременната номенклатура 4 от видовете сега са синоними на други видове в списъка, а един вид е понижен в подвид. Сравняването на списъка от 1983 и каталога от 1998 показва, че в каталога са прибавени още 31 със сигурност срещащи се видове и 11 с вероятно погрешни данни. От прибавените сигурни видове 15 са по стари литературни данни, но пропуснати в списъка на GANEV (1983), а други 16 вида са публикувани за България от Юлий Ганев, Стоян Бешков, Екамерина Несторова и някои чуждестранни лепидоптеролози след списъка.

Каталогът е съставен съвестно, но при по-подробно разглеждане правят впечатление някои пропуски и несъответствия. В увода е споменато, че

хоризонталното разпространение се дава според морфозеографската подялба на страната в География на България (1966), но приложената карта и списък на областите и районите не е взета от География на България, а от HUBENOV (1997, Acta zool. bulg., 49: 5-9) без това да е отбелязано.

Scopula nemoraria (Hübner) би трябвало да се извади от категорията на сигурните видове, тъй като не е публикуван за страната през последните 70 години и е изразявано мнение за грешното му определяне. Същото важи и за *Rheumaptera subhastata* (Nolck.), който авторката смята за неправилно определен от Д. Гогов. Съмнителните видове са дадени понякога с „оригиналната комбинация“, т.е. както са публикувани в литературата за България, напр. *Acidalia coenosaria* Led. вместо *Scopula coenosaria*, а понякога според съвременната номенклатура, напр. *Idaea litigiosaria* (Boisd.) вместо *Acidalia litigiosaria*.

Въпреки сравнително пълния списък на литературата за България в него липсват някои публикации с описания на нови за науката подвидове от България, като MILLIÈRE (неправилно изписан в каталога като Müller), 1868, Icon. Descr. Chén. Léop. inéd., 2: 433 (*Catarhoe putridaria bulgariata*); REISSER, 1936, Ent. Rundsch., 53: 135 (*Nebula nebulata pirinica*); VARGA, 1975, Acta Biol. Debrecina, 12: 77-90 (*Gnophos glaucinarius peruni*, *Psodos coracina bureschi*).

В каталога фигурират два подвигда на *Nebula salicata* (Hübner), но не е посочено кой е първият подвиг. Освен това хоризонталното и вертикалното разпространение в България и общото разпространение показват, че вероятно те не представляват подвидове. Не изглежда правдоподобно и обединяването в един подвиг на *Catarhoe permixtaria* (H.-Sch.) и *Catarhoe putridaria* (H.-Sch.), след като според BUSSE & OCKRUCK (1991, Phegea, 19: 5-20) и други автори те са два вида. Липсва тълкуване защо не са включени като самостоятелни подвидове *Apocheima hispidaria popovi* Vojn., *Nychiodes dalmatina andreasaria* Warn. и *Ascotis selenaria bureschi* Karn., които се признават от чуждестранни и наши съвременни автори. Е. Несторова посочва, че според FORSTER & WOHLFAHRT (1981) *Protorhoe corollaria* (H.-Sch.) е синоним на *Protorhoe unicata* (Guenée), което е невъзможно. Възможно е обратното, защото вторият вид е описан след първия и защото е считан от БАХМЕТЬЕВ (1902, op. cit.) за вариетет от него. Всъщност FORSTER & WOHLFAHRT (1981, Schmiett. Mitteleur., 5: 120) не споменават за синонимия, а за грешно определяне на *Pr. unicata* от някои автори като *Pr. corollaria*. Неправилно е и твърдението на Е. Несторова, че според REBEL (1903, op. cit.) *Cidaria bicolorata* (Hufn.) [сега *Plemyria rubiginata* (Den. et Schiff.)] е погрешно определен вид. В действителност REBEL (1903, op. cit.) пише само, че видът е бил намерен от А. Дреновски край София.

Независимо от тези единични пропуски каталогът на Екатерина Несторова е много полезен справочник за богатото на видове семейство Geometridae. Трябва да поздравим Издателство Pensoft за инициативата да възобнови след шестгодишно прекъсване издаването на Каталогзи на българската фауна, от които Издателството на БАН отпечата само първия том (DETCHIEVA R. 1992. Protozoa, Ciliophora. - In: Catalogi faunae bulgaricae. 1. Sofia, Aedib. Acad. sci. bulg., 135 p.).

УКАЗАНИЯ ЗА АВТОРИТЕ

В периодичното издание *Historia naturalis bulgarica* се отпечатват оригинални статии из природонаучната музейна проблематика (музеология, информации върху музейни колекции и пр.), статии из историята на природознанието и научни приноси по зоология, ботаника, палеонтология и геология въз основа на материали предимно от български и чуждестранни музеи. Публикациите са на един от следните езици: български (с резюме на западен език), английски, немски, френски и руски (с резюме на български език). При подготовката на ръкописите трябва да се имат предвид следните изисквания:

1. Ръкописът се предава на дискета на програмата Word за Windows и с една разпечатка. Файлът да съдържа само един шрифт (без отстъпи, без използване на Bold, без текстове само с главни букви, без поредни интервали и друго ненужно форматиране). Заглавието, главите и новите абзаци да се отделят с един празен ред. Използва се курсив (само за имената на таксоните от родовете и видовете група) и изцяло главни букви (за цитираните в текста и литературния списък автори, но не и за авторите на таксоните). Разпечатката да бъде на стандартни машинописни страници (30 реда x 60 знака). Ръкописът да бъде напълно комплектован (ако е необходимо с литературен списък, таблици, фигури, текст към тях, резюме на съответния език).

2. Максималният обем на статията (вкл. приложенията и илюстрациите) не трябва да надхвърля 20 стандартни страници. По-големи статии се приемат само с решение на редакционната колегия.

3. Авторът да се изпише с пълно собствено и фамилно име.

4. Цитирането на литературните източници в текста да бъде по един от следните начини: "ЙОСИФОВ (1996)" или "(ЙОСИФОВ, 1996)" или "JOSIFOV and KERZHNER (1995)" или "(JOSIFOV & KERZHNER, 1995)" или "(GOLEMANSKY et al., 1993; БЕШОВСКИ и др., 1994; JOSIFOV, 1995; 1996)". При трима и повече автори се използва "et al." или "и др.". В статиите на латиница цитирането е само на латиница.

5. Литературният списък включва само източници, цитирани в текста на статиите и подредени по азбучен ред. В статиите на български се изреждат авторите на кирилица, следвани от тези на латиница. В статиите на западен език всички автори се подреждат по общ азбучен ред на латиница (ако статия или книга е написана на кирилица, ползва се заглавието на резюмето, а ако няма таква - заглавието се прежда, а не транслитерира).

Примери за библиографско описание:

TANASILTCHUK V., V. BESCHOVSKI. 1990. A contribution to the study of *Chamaemyia* from Bulgaria. - *Acta zool. bulg.*, 41: 18-25.

ЙОСИФОВ М. 1987. Фенология и зоогеография при насекомите. - В: Съвременни постижения на българската зоология. С., БАН, 17-20.

ГРУЕВ Б. 1988. Обща биогеография. С., Наука и изкуство. 396 с.

GOLEMANSKY V., P. YANKOVA. 1973. Studies on Coccidia in some small mammals in Bulgaria. - *Bull. Inst. zool. mus.*, 37: 5-31. (In Bulgarian).

6. След литературата следва пълният адрес на автора или авторите.

7. Резюмето се предава преведено на съответния език и не трябва да надхвърля 30 реда.

8. Таблиците се номерират и са със заглавие отгоре. Ако са на компютър, да не се използват интервали и табулатор; да не се разделят с вертикални, а само с хоризонтални линии.

9. Рисунките, чертежите и фотографиите се означават като "фиг." и се номерират (да се избягва използването на цифра и буква или на две цифри) и трябва да са съобразени със следните изисквания:

- фотографиите да бъдат ясни, контрастни, по възможност с еднакъв размер в една статия; ако върху тях трябва да се направят допълнителни означения (цифри, стрелки, букви и пр.), те се нанасят на прозрачна хартия, прикрепена към фигурата,

- чертежите (графики, диаграми) и рисунките се представят в голям за възпроизвеждане вид и до тройно по-големи от размера им в печатната страница.

От всяка публикация се получават безплатно по 40 авторски отпечатъка.

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